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Royal Botanic Gardens Melbourne
Birdwood Avenue
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A new species of *Lepraria* (lichenized Ascomycetes) from Tasmania's wet forests

Gintaras Kantvilas[1] *and Martin Kukwa*[2]

[1] Tasmanian Herbarium, Private Bag 4, Hobart, Tasmania 7001, Australia.
[2] Department of Plant Taxonomy and Nature Protection, Gdansk University, Al. Legionow 9, PL-80 441 Gdansk, Poland.

Abstract

Lepraria toilenae Kantvilas & Kukwa is described from Tasmania. This species is characterised by a green to grey-green, leprose, non-lobate thallus containing malonprotocetraric, fumarprotocetraric and roccellic acids.

Introduction

The genus *Lepraria* Ach. is well-represented in the Tasmanian flora. McCarthy (2003) records four species for the island: *Lepraria incana* (L.) Ach, *L. lobificans* Nyl., *L. membranacea* (Dicks.) Lettau and *L. vouauxii* (Hue) R.C. Harris, the last two taxa as *Leproloma* Nyl. ex Crombie, a genus now regarded as a synonym of *Lepraria* (Ekman & Tonsberg 2002; Kukwa 2002). However, on the basis of chemical composition alone, many more additional taxa appear to be present, containing various combinations of depsides, depsidones, dibenzofurans and fatty acids.

In Tasmania, *Lepraria* is represented in most vegetation types, including wet and dry forests, alpine and coastal heathland, and urban or man-made environments. As in other parts of the world, species of *Lepraria* can inhabit soil, bark, wood or rock, and frequently favour sheltered sites where they are protected from direct sunlight and from wetting by rain. A particularly important habitat is found on the trunks of very old trees and, as a result, some species of *Lepraria* may well serve as old-forest indicators. Ongoing studies in Tasmania's old-growth eucalypt forests have shown one such *Lepraria* species to be abundant on the massive trunks of the oldest trees. This species is new to science and is described here.

Methods

Thallus morphology was studied using low-power microscopy. Anatomical observations at high-power were made on portions of thallus mounted in water. Thin-layer chromatography (TLC) was undertaken using standard methods, specifically solvents A, C and G (Orange *et al.* 2001).

Taxonomy

Lepraria toilenae Kantvilas & Kukwa, *sp. nov.*

Thallus crustaceus, ubique leprosus, elobatus, acidum roccellicum, acidum malonprotocetraricum et substantias affines continens, sorediis farinosis, super hypothallum bene evolutum, album vel griseo-album dispersis; algae chlorococcoideae.

Type: Tasmania, West of Tahune Bridge in the Warra SST, at edge of coupe WR0081, 43°06'S 146°40'E, 90 m altitude, on dry trunk of large *Eucalyptus obliqua* in

wet sclerophyll forest, 10 May 2005, *G. Kantvilas 121/05* (holotype HO; isotypes BG, BM, UGDA).

Thallus leprose-sorediate, thick or thin, lacking well-defined lobes, whitish green to greenish grey, diffuse and forming extensive, irregularly spreading patches to 50 cm wide, less commonly in small, irregularly roundish, ± delimited colonies *c.* 3–5 mm wide that eventually coalesce; medulla absent; hypothallus very well developed, white or rarely pale greyish white, forming a thick weft covered with soredia except for a soredia-free zone at the thallus margins, composed of branched and occasionally anastomosing hyphae 2.5–4 µm thick with smooth or rough walls; soredia farinose, dispersed over the hypothallus or forming a thick, continuous layer, ± roundish, 16–40 µm wide, surrounded by an incomplete 'wall', sometimes aggregated in roundish to slightly elongated clumps (consoredia) to *c.* 80 µm wide, very rarely with a few projecting hyphae to 15 µm long; photobiont chlorococcoid, with individual cells 5–8(–10) µm diam.

Chemistry: Thallus K-, KC-, C-, P+ red, UV-; containing malonprotocetraric (major), fumarprotocetraric (submajor), protocetraric (minor) and confumarprotocetraric (trace) acids and roccellic acid (by TLC).

Etymology: The specific epithet is derived from the Tasmanian aboriginal word 'toilena' meaning 'stringy bark' (Plomley 1976); this refers to *Eucalyptus obliqua* L'Hérit., the tree which is the most common host for this lichen.

Observations: The new species is characterized morphologically by the green to greenish grey, powdery, non-lobed thallus and chemically by the production of roccellic acid and an unusual combination of depsidones that includes malonprotocetraric acid (not known previously from *Lepraria*) and fumarprotocetraric acid as major substances. This combination of characters is unique in the genus *Lepraria*. Only two *Lepraria* taxa, *L. caesioalba* (de Lesd.) J.R.Laundon (chemotype I) and *L. nivalis* J.R.Laundon (chemotypes I-III) are known to produce fumarprotocetraric and/or protocetraric acids (usually accompanied by atranorin), but neither of these contains malonprotocetraric acid (Laundon 1992; Leuckert *et al.* 1995, 2004). In addition, these species differ morphologically: *L. caesioalba* has a granular, grey thallus, whereas the thallus of *L. nivalis* is white to pale grey and sublobed, and the soredia usually posses projecting hyphae (Laundon 1992). Morphologically *L. toilenae* is quite similar to *L. atlantica* Orange, *L. jackii* Tønsberg and *L. toensbergiana* Bayerová & Kukwa. However, these all have a different chemistry that can be demonstrated easily by TLC: all of them contain atranorin and fatty acids, with additional porphyrilic acid in *L. atlantica* (Kümmerling *et al.* 1995; Orange 2001; Bayerová *et al.* 2005). None of the five taxa mentioned above has been reported from Tasmania, and only *L. caesioalba* and *L. jackii* are known from the Southern Hemisphere (Laundon 1992; Kümmerling *et al.* 1995; Aptroot *et al.* 1997; Orange 2001, Leuckert *et al.* 2004; Bayerová *et al.* 2005).

In the Tasmanian flora, *Lepraria toilenae* can be identified with certainty only by chemical means. There is one additional, unidentified species that contains fumarprotocetraric acid and related substances, but this also contains atranorin. Likewise, fatty acids are known in several unidentified taxa, but these occur either alone or together with atranorin. All the material concerned requires further study. The lichen most easily confused with the new species is *Cladia schizopora* (Nyl.) Nyl. Extreme forms of the *Cladia* lack the typical, perforate pseudopodetia and form a sterile, sorediate, *Lepraria*-like crust. Whereas both taxa contain protocetraric and fumarprotocetraric acids, *Lepraria toilenae* differs chemically by containing additional

malonprotocetrariae acid and roccellic acid, the latter albeit in trace amounts. The two taxa differ morphologically by the *Lepraria* having a whitish, ± byssoid hypothallus covered in coarse soredia. The hypothallus is clearly visible through the layer of soredia and at the thallus margins.

Ecology and distribution: Lepraria toilenae is currently known from several widely scattered localities, but it is likely to be more widespread but overlooked elsewhere because the genus as a whole has never been the focus of a specific scientific study in Tasmania. The new species occurs on bark and has been recorded from wet eucalypt forest and cool temperate rainforest. It is particularly common at the type locality where it is a constant epiphyte on very large (sometimes greater than 250 cm dbh), very tall (to 65 m) *Eucalyptus obliqua* trees (family Myrtaceae). There it forms extensive colonies up to 50 cm across or more on the dry, sheltered sides of the lower trunk and buttress. The bark in such habitats is thick, fibrous and often lightly charred from past wildfires. Other trees that are known to support the new lichen include *Nothofagus cunninghamii* (Hook.) Oersted (Fagaceae) and the long-lived conifer *Lagarostrobos franklinii* (Hook.f.) Quinn (Podocarpaceae). These trees tend to have flaky bark that forms plates.

The apparent restriction of *Lepraria toilenae* to the dry bark of very large trees in wet forest is rather unusual within the Tasmanian *Lepraria* flora. All of the other better-known, named Tasmanian species tend to have rather broad ecological amplitudes, occurring on bark, wood or soil, and in a wide range of vegetation types.

The type locality of *Lepraria toilenae* is a commercial forest that is being harvested for timber and is the subject of a detailed, ongoing study of lichens and bryophytes (Jarman & Kantvilas 2001 a, b). During this work, the status of the new species was overlooked due to its superficial resemblance to heavily sorediate forms of *Cladia schizopora* (see above). Other species associated with *Lepraria toilenae* include *Micarea micrococca* (Körber) H. Gams, *Placynthiella icmalea* (Ach.) Coppins & P. James, *Hypocenomyce foveata* Timdal, *Chaenotheca hygrophila* Tibell and species of *Chaenothecopsis* Vain. (Kantvilas & Jarman 2004).

Selected specimens examined (total = 14): **TASMANIA:** e. 3 km S of Teepookana, 42°13'S 145°26'E, 220 m altitude, 7 Nov. 1990, *G. Kantvilas* 626/90 (HO); W of Savage River Pipeline Road, Coupe RD 22A, 41°13'S 145°19'E, 450 m altitude, 25 Nov. 2003, *G. Kantvilas* 666/03 (HO); Weindorfers Forest, 41°38'S 145°56'E, 920 m altitude, 30 Mar. 1988, *G. Kantvilas s.n.* (HO); W of Tahune Bridge in the Warra SST, Big Coupe, 43°06'S 146°41'E, 180 m altitude, 25 Jan. 2000, *G. Kantvilas* 69/00 (HO, UGDA); same locality, Middle Coupe CFI plot, 43°06'S 146°41'E, 130 m altitude, 17 Jul. 1998, *G. Kantvilas s.n.* (HO, UGDA); Warra Creek, site S18, 43°05'S 146°43'E, 250 m altitude, 19 Jun. 1996, *G. Kantvilas s.n.* (HO); Boyd Lookout, 42°49'S 146°22'E, 550 m altitude, 24 Nov. 1981, *G. Kantvilas s.n.* (HO); Bluff River Gorge, 42°31'S 147°40'E, 200 m altitude, 30 May 2005, *G. Kantvilas* 135/05 (HO); Walls of Jerusalem walking track carpark, 41°47'S 146°14'E, 730 m altitude, 14 Aug. 2005, *G. Kantvilas* 245/05 (HO).

Acknowledgement

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References

Aptroot, A., Diederich, P., Sérusiaux, E. and Sipman H. J. M. (1997). Lichens and lichenicolous fungi from New Guinea. *Bibliotheca Lichenologica* **64**, 1-220.

Bayerová, Š., Kukwa, M. and Fehrer, J. (2005). A new species of *Lepraria* (lichenized Ascomycetes) from Europe. *Bryologist* **108**, 131-138.

Ekman, S. and Tonsberg, T. (2002). Most species of *Lepraria* and *Leproloma* form a monophyletic group closely related to *Stereocaulon*. *Mycological Research* **106**, 1262-1276.

Jarman, S.J. and Kantvilas, G. (2001a). Bryophytes and lichens at the Warra LTER site. I. An inventory of species in *Eucalyptus obliqua* wet sclerophyll forest. *Tasforests* **13**, 193-216.

Jarman, S.J. and Kantvilas, G. (2001b). Bryophytes and lichens at the Warra LTER site. II. Understorey habitats in *Eucalyptus obliqua* wet sclerophyll forest. *Tasforests* **13**, 217-243.

Kantvilas, G. and Jarman, S.J. (2004). Lichens and bryophytes on *Eucalyptus obliqua* in Tasmania: management implications in production forests. *Biological Conservation* **117**, 359-373.

Kukwa, M. (2002). Taxonomic notes on the lichen genera *Lepraria* and *Leproloma*. *Annales Botanici Fennici* **39**, 225-226.

Kümmerling, H., Leuckert, C. and Wirth, V. (1995). Chemische Flechtenanalysen XI. *Lepraria jackii* Tonsberg. *Nova Hedwigia* **60**, 457-465.

Laundon, J.R. (1992). *Lepraria* in the British Isles. *Lichenologist* **24**, 315-350.

Leuckert, C., Kümmerling, H. and Wirth, V. (1995). Chemotaxonomy of *Lepraria* Ach. and *Leproloma* Nyl. ex Crombie, with particular reference to Central Europe. *Bibliotheca Lichenologica* **58**, 245-259.

Leuckert, C., Wirth, V., Kümmerling, H. and Heklau, M. (2004). Chemical lichen analyses XIV. *Lepraria nivalis* J. R. Laundon and *Lepraria flavescens* Cl. Roux & Tonsberg. *Bibliotheca Lichenologica* **88**, 393-407.

McCarthy, P.M. (2003). *Catalogue of Australian Lichens*. Flora of Australia Supplementary Series Number 19. Australian Biological Resources Study: Canberra.

Orange, A. (2001). *Lepraria atlantica*, a new species from the British Isles. *Lichenologist* **33**, 461-465.

Orange, A., James, P.W. & White, F.J. (2001). *Microchemical Methods for the Identification of Lichens*. British Lichen Society: London.

Plomley, N.J.B. (1976). *A Word-list of the Tasmanian Aboriginal Languages*. Privately published, Launceston, Tasmania.

Muelleria 23: 7–14 (2006)

New subspecies of *Leionema bilobum* (Rutaceae)

Marco F. Duretto [1,4], *Kylie L. Durham* [2], *Elizabeth A. James* [3] *and Pauline Y. Ladiges* [2]

[1] Tasmanian Herbarium, Tasmanian Museum and Art Gallery, Private Bag 4, Hobart Tas. 7001.

[2] School of Botany, The University of Melbourne, Vic. 3010.

[3] National Herbarium of Victoria, Royal Botanic Gardens Melbourne, Birdwood Ave., South Yarra, Vic. 3141.

[4] Corresponding author: marco.duretto@tmag.tas.gov.au

Abstract

Morphological variation in *Leionema bilobum* (Lindl.) Paul G. Wilson is described taxonomically as four subspecies: viz. subsp. *bilobum*, which is restricted to the eastern ranges of Grampians National Park, Victoria; subsp. *thackerayense* Duretto & K.L.Durham *subsp. nov.*, which is restricted to the Victoria Range, Grampians National Park, and the nearby Black Range, Victoria; subsp. *truncatum* (Hook.f) Duretto & K.L.Durham *stat. et comb. nov.*, which is endemic to Tasmania; and subsp. *serrulatum* (F.Muell.) Duretto & K.L.Durham *stat. et comb. nov.*, which is restricted to the Eastern and Gippsland Highlands, Victoria. A key is provided and all subspecies are illustrated.

Introduction

Phebalium bilobum Lindl. was described by Lindley (in Mitchell 1838) from material collected by Major Thomas Mitchell on his third expedition into the interior of Eastern Australia. The type material came from Mt William, the Grampians Ranges, western Victoria. When describing *Eriostemon hillebrandii* F.Muell., Mueller (1854) included *P. bilobum* as a synonym, thus rendering *E. hillebrandii*, and the two varieties of *E. hillebrandii* he described in that publication, illegitimate. Mueller's varieties are *E. hillebrandii* var. *brevifolius* F.Muell. from the Mt Lofty Ranges (though he did state Victoria Ranges in error - see Willis 1957, Wilson 1970) and *E. hillebrandii* var. *longifolius* F.Muell. from Mt William. In 1855 Hooker described *P. truncatum* Hook.f. from material collected in Tasmania and later Mueller (1858), still adopting a broad view of *Eriostemon* Sm., described *E. serrulatus* F.Muell. from Gippsland (Victoria). *Eriostemon hillebrandii, P. truncatum* and *E. serrulatus* were placed under *P. bilobum* by Bentham (1863) who stated that the species was found in South Australia, Victoria and Tasmania. Engler (1931, p. 260) does cite a '*Ph. Hillebrandii* F.Müll.' under *P. bilobum* but this is not a legitimate combination. In the first half of the 20th Century most regional floras adopted a broad view of *P. bilobum*, following Bentham (1863). Willis (1957) considered *P. bilobum* to be too diverse and erected *P. hillebrandii* J.H.Willis (based on *E. hillebrandii* var. *brevifolius*) for the South Australian material and referred all Tasmanian and Victorian material to *P. bilobum*.

When revising *Phebalium* Vent., Wilson (1970) discussed variation found in *P. bilobum* and indicated that each of the three areas of distribution (viz. the Grampians Ranges, west Gippsland and Tasmania) had a morphologically distinctive race. With the limited material he had at hand, he concluded that these forms did not warrant recognition as subspecific taxa. Later Wilson (1998) transferred those species he had

placed in *Phebalium* section *Leionema* (F.Muell.) Benth. into the new genus *Leionema* (F.Muell.) Paul G.Wilson and made the new combination *L. bilobum* (Lindl.) Paul G.Wilson. *Leionema bilobum* is found in south-eastern Australia and has a particularly disjunct distribution: in Victoria it is found in the Grampians Ranges and nearby Black Range, the southern parts of the Eastern Highlands and the Gippsland Highlands, and in Tasmania it is found on Flinders and Cape Barren Islands (Furneaux Group), in the northern and eastern areas of the island of Tasmania, and on some near shore islands on the east coast.

Durham (1998) analyzed the morphological and isozyme variation found in *L. bilobum*. In this study, four morphological groups were identified: group 1 from Mt William, Wonderland Range, and Serra Range from the Grampians; group 2 from Tasmania; group 3 from the Victoria Range of the Grampians Ranges; and group 4 from the Eastern and Gippsland Highlands. Durham (1998) concluded that the four groups deserve taxonomic recognition at the subspecific level but did not publish any formal nomenclature.

The opportunity is taken here to publish an account of these taxa in anticipation of the forthcoming *Flora of Australia* treatment of the family. Group 1 (of Durham 1998) matches the type of the species and refers to *L. bilobum* subsp. *bilobum*. Group 2 corresponds to *E. truncatum* and so the new combination, *L. bilobum* subsp. *truncatum* (Hook.f.) Duretto & K.L.Durham is made. Group 3 is here described as *L. bilobum* subsp. *thackerayense* Duretto & K.L.Durham. Group 4 matches the type of *E. serrulatum* and so the new combination, *L. bilobum* subsp. *serrulatum* (F.Muell.) Duretto & K.L.Durham, is made.

Taxonomy

Leionema bilobum (Lindl.) Paul G.Wilson, *Nuytsia* 12: 271 (1998); *Phebalium bilobum* Lindl. in T. Mitch., Three Exped. Australia 2: 177 (1838); *Eriostemon hillebrandii* F.Muell. *Trans. Philos. Soc. Victoria* 1: 10 (1854), *nom. illeg.* [*P. bilobum* cited in synonymy]. Type: **VICTORIA:** GRAMPIANS: Mt William, 15 July 1836, *T. Mitchell 249* (holotype: CGE *n.v.*, photograph CANB *fide* Wilson, *Nuytsia* 1: 108 (1970); isotypes: K *278729*, images HO *532028* & MEL, MEL *1599695*). NOTE: MEL *1599695* has the collector's number '249' and J.H. Willis, on a determination slip dated 24 July 1963, noted that the specimen was a 'duplicate type' that was collected by John Richardson. K *278729* does not have collection details apart from 'Major Mitchell's Expedition' and is a good match of MEL *1599695*.

Shrub or small tree to 4 m high; *branchlets* slender, terete or slightly angular when young, with a moderately dense to dense indumentum of stellate hairs. *Leaves* with petioles to 2.5 mm long; lamina chartaceous, shortly ovate-oblong and constricted below apex (Grampians, Tas.) or narrowly elliptic-oblong or oblong (Gippsland), 7–52 mm long, 2–10 mm wide, apex truncate to strongly retuse, minutely glandular punctate, sparsely stellate-hairy to glabrous, midrib slightly impressed above, margins flat or slightly recurved, entire to strongly serrate. *Inflorescence* a terminal cyme, 5–10-flowered; flowers in axils of small terminal bracts or in short pedunculate clusters; pedicels 2–8 mm long, green or red, glabrous or glabrescent or sparsely to densely minutely stellate-hairy. *Sepals* deltate, c. 0.5–0.75 mm long, sparsely stellate-hairy. *Petals* white, pink or red towards apex or sometimes red or pink on abaxial surface, narrowly elliptic, 3–5 mm long, glabrous. *Stamens* subequal to petals, anthers pale yellow. *Disc* short-cylindric, red or green. *Carpels* 2–3(–4), glabrous or rarely hirsute.

Cocci narrowed at apex with terminal rostrum c. 1 mm long, smooth, 4–7 mm long. Flowering May-Nov.; fruiting Oct.-Feb. **Notched Phebalium.** (Fig. 1)

Key to the subspecies of *Leionema bilobum*

1. Margin of leaves smooth, not serrate, nor bilobed at tip .....subsp. **2.** ***thackerayense***
1: Margin of leaves serrate, sometimes only slightly so and then bilobed at the tip..... 2

2. Base of leaves usually truncate, sometimes slightly cordate or rounded; hairs on stem 0.5–1 mm long (Vic. - Grampians Ranges) .....subsp. **1.** ***bilobum***
2: Base of leaves cuneate or attenuate; hairs on stem to 0.25 mm long (Vic. - Gippsland area; Tas.)..... 3

3. Leaves 12–25 mm long, leaf length: leaf width at the broadest point 1.2–4(–7); shrub, 0.5–2 m tall (Tas.) .....subsp. **3.** ***truncatum***
3: Leaves 16–52 mm long (longest leaf > 30 mm long), leaf length: leaf width at the broadest point 4–7; tall bush or small tree, to 4 m tall (Vic. - Gippsland area)..... subsp. **4.** ***serrulatum***

1. ***Leionema bilobum*** (Lindl.) Paul G.Wilson subsp. ***bilobum***

Eriostemon hillebrandii var. *lougifolius* F.Muell., *Trans. Philos. Soc. Victoria* 1: 10 (1854), *nom. illeg.* as *E. hillebrandii nom. illeg.* [see details under *L. bilobum* above]. Types: **VICTORIA**: GRAMPIANS: Mt William, November 1853, *F. Mueller* (syntypes: MEL *4616, 4611*); Grampians, *F. Mueller* (possible syntype: MEL *4608*).

Leionema bilobum subsp. 1 (Grampians), *fide* Ross and Walsh (2003).

Shrub 0.1–0.6(–2.5) m high; rays of hairs 0.5–1 mm long. *Leaves* narrow-lanceolate, 9–19 mm long, 2–8 mm wide, longest leaf usually 14–18 mm long, leaf length : leaf width 1.5–5(–9), margins serrate, lamina constricted below apex, apex strongly obcordate or retuse, base usually truncate, sometimes slightly cordate or rounded. *Pedicels* 2–8 mm long, glabrous or glabrescent or sparsely to densely minutely stellate-hairy. *Sepals* 0.5–0.75 mm long, usually with a tuft of hairs at the tip or sparsely pubescent. *Petals* white, 3–5 mm long. *Carpels* glabrous to densely pilose. Flowering May-Nov.; fruiting Dec.-Feb. (Fig. 1a-e).

Selected specimens seen: **VICTORIA**: GRAMPIANS: Asses Ears, c. 3 km S along Wallaby Rocks road from its intersection with Asses Ears Road, 37°07'S 142°18'E, 14 Oct. 1986, *J. Westaway 321* (MEL); beside track about 1.3 m below summit of Mt Rosea, 37°08'S 142°26'E, 10 Oct. 1962, *T.B. Muir 2598* (HO, MEL); c. 2 km SW from Halls Gap at the Grand Canyon, 37°08'S 142°02'E, 11 May 1992, *V. Stajsic* (MEL *2011179*); West of road between Tower Hill and Stony Cr., 37°12'S 142°29'E, 10 Nov. 1976, *P.K. Gullan* (MEL); upper western slopes of Boronia Peak, 25 Sept. 1959, *T.B. Muir 841* (MEL, NSW); Redman road, 3 km S from Lake Bellfield, 37°13'S 142°35'E, 28 Sep. 1991, *V. Stajsic 323* (MEL); A-top Mt Clung, E side of Serra Range, 9 Jun. 1968, *A.C. Beauglehole 25270* (MEL); Wallaby Rocks, 1 Oct. 1967, *A.C. Beauglehole 25270 and Corricks* (MEL); On track to Reeds Lookout, 7 Oct. 1967, *D.J.E. Whibley 2094* (MEL); on road to Mirranatwa Gap, 1.3 km W of main Grampians road, 37°26'S 142°27'E, 3 Sept. 1997, *P.G. Neish 398* (MEL); Mt Difficult, among rocks above lookout point, 9Nov. 1963, *J.H. Willis* (MEL *2101036*); Kalymna Falls, Mt William Creek, 11 Dec. 1967, *A.C. Beauglehole 16571* (MEL); 1.5 miles NE of Silverband Falls, 28 Oct. 1952, *R.* miles (2 km)

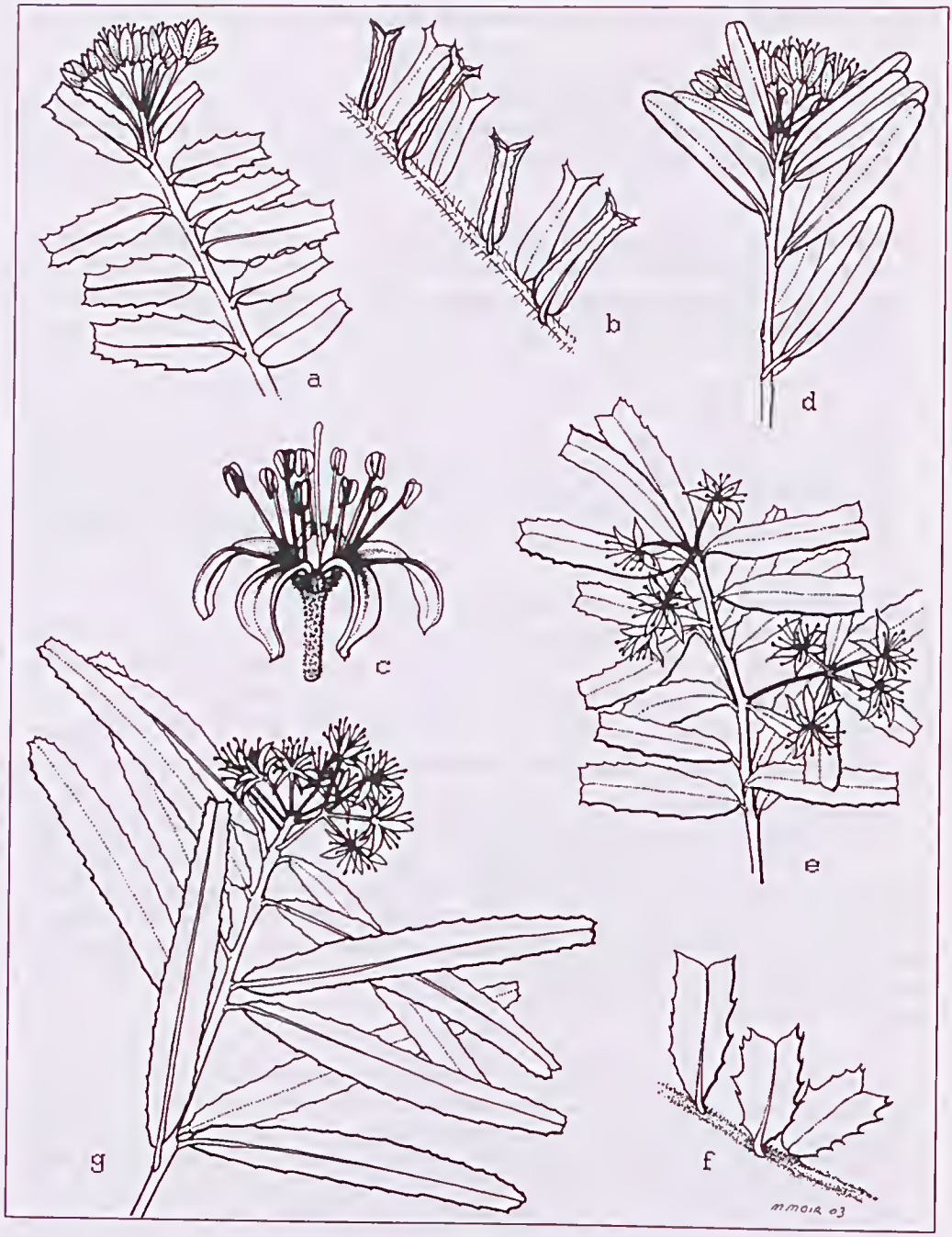

Figure 1. a-c, *Leionema bilobum* subsp. *bilobum*: a, b - habit, × 1.5; c - flower, × 4 (a, c - *Neish 398* [MEL]; b - *Melville 1791* [MEL]). d, *L. bilobum* subsp. *thackerayense*: habit, × 1.5 (*Filson 5293* [MEL]). e-f, *L. bilobum* subsp. *truncatum*: habit × 1.5 (e - *Moscal 451* [HO]; f – *Milligan 619* [HO *4949*]). g, *L. bilobum* subsp. *serrulatum*: habit × 1.5 (*Seebeck* [MEL *693016*]).

above Mafeking Huts, 30 Oct. 1971 , *J.H. Willis* (MEL *501859*, NSW); Wonderland Range, near car park, 17 Sep. 1955, *A.C. Beauglehole 7226* (MEL).

Distribution and ecology: *Leionema bilobum* subsp. *bilobum* is restricted to the eastern parts of Grampians National Park including Mt William, Mt Difficult, and the Wonderland and Serra Ranges. The taxon is found in heath and *Eucalyptus* or *Banksia* woodland on sandstone.

Conservation code: Ross and Walsh (2003) considered this taxon to be rare. All known populations are found in the Grampians National Park.

2. *Leionema bilobum* subsp. ***thackerayense*** Duretto & K.L.Durham, *subsp. nov.*

A subspecie typica foliis marginibus laevibus differt.

Type: **VICTORIA**: GRAMPIANS: Victoria Range Road, 25 Oct. 1976, *P.G. Mathews* (holotype: MEL *524253*).

Leionema bilobum subsp. 2 (Victoria Range), *fide* Ross and Walsh (2003).

Shrub 0.2–1.5 m high; rays of hairs to 0.25(–0.5) mm long. *Leaves* narrowly elliptic-oblong to slightly lanceolate, 7–33 mm long, 2–6 mm wide, longest leaf usually 28–33 mm long, leaf length : leaf width 3.5–6.2, margins smooth, apex slightly truncate or retuse to obtuse, base more or less cuneate. *Pedicels* 3–7 mm long, glabrous or glabrescent. *Sepals* c. 0.5 mm long, glabrous or few hairs at tip. *Petals* white, 3–4 mm long. Carpels glabrous. Flowering Aug.-Nov.; fruiting material collected in Nov. (Fig. 1d)

Specimens seen: **VICTORIA**: GRAMPIANS: Victoria Range near Mt Thackeray, Deep Creek, 37°19'S 142°16'E, 20 Aug. 1986, *J.A. Armstrong 5084* (MEL); Victoria Range, Castle Rock, 6 Nov. 1966, *A.C. Beauglehole 15885* (MEL); Victoria Range, Castle Rock, 11 Nov. 1966, *A.C. Beauglehole and J.H. Willis ACB16128* (MEL); Ridge near Kappa Cave, Victoria Range, 16 Sep. 1963, *R. Filson 5293* (MEL, NSW); Victoria Range Rd, D/18/C/11d, 25 Oct. 1976, *P.G. Mathews* (MEL *524253*); Goats Track, rocky outcrop near sharp bend on road, Victoria Ra., Grampians N.P., 37°17'S 142°21'E, 28 Feb. 1998, *K.L. Durham 1–5, M.F. Duretto and P.Y. Ladiges* (*KLD 1, 3, 5* – MEL; *KLD 2, 4* – HO, MEL).

Distribution and ecology: *Leionema bilobum* subsp. *thackerayense* is found in the western parts of the Grampians National Park, with most collections being made near and on Mt Thackeray, Victoria Range. Plants have been seen on the Black Range to the west of Grampians Ranges (MFD pers obs; at c. 37°10'S 142°0'E). The subspecies is found in rocky areas (usually sandstone) in or near eucalypt woodland. Sometimes it is found growing in boulder fields.

Conservation status: Ross and Walsh (2003) considered that there was insufficient information to formulate the conservation status of this subspecies, which unfortunately appears to be true. Populations seen during this study were isolated and small. Further detailed field surveys are required to ascertain the conservation status of *L. bilobum* subsp. *thackerayense*. Most populations are found in Grampians National Park.

Etymology: The subspecific epithet refers to Mount Thackeray, the peak near which the majority of collections have been made.

3. *Leionema bilobum* subsp. ***truncatum*** (Hook.f.) Duretto & K.L.Durham, *stat. & comb. nov.; Phebalium truncatum* Hook.f., Fl. Tasm. 1: 64, t 9 (1855). Type citation:

"Flinder's Island, in Bass' Straits, and Schouten Island, East Coast, *Gunn* [1947]". Type: TASMANIA: EAST COAST: Schouten Island, East Coast, V.D.L. [Tasmania], Aug. 1844, [*J. Milligan* ?] *Gunn 1947* (lectotype, here designated, K *278731*, images HO *532027* & MEL); FURNEAUX: Flinders' Island & Cape Barren Island, Oct. 1844, *J. Milligan 619* [*Gunn* 1947] (residual syntype: K *278732*, images HO *532027* & MEL; residual isosyntype: HO *4944*); Flinders' Island, *J. Milligan 619* (possible residual isosyntype: MEL *4626*).

Shrub 0.5–2 m high; hairs with rays to 0.25 mm long. *Leaves* ovate-oblong to narrow oblong-ovate, 12–25 mm long, 3–10 mm wide, longest leaf usually 11–24 mm long, leaf length : leaf width 1.2–4(–7), margins serrate, serrations often prominent, rarely with only a few small serrations, apex truncate to strongly obcordate, base usually cuneate. *Pedicels* 2.5–5 mm long, glabrescent. *Sepals* c. 0.5 mm long, with a dense tuft of hairs at tip. *Petals* white, 3–4 mm long. *Carpels* glabrous. Flowering (Aug.) Sep.-Nov.; fruiting Oct.-Jan. (Fig. 1e, f).

Selected specimens seen: TASMANIA: FURNEAUX GROUP: Top of Mt Killiecrankie, Flinders Island, 39°49'S 147°51'E, May 1877, *A. Simson 622* (HO); Mount Tanner, Flinders Island, 39°53'S 147°49'E, 10 Dec. 1975, *M.P. Cameron and W.M. Curtis* (HO *29727*); Upper reaches of Pats River, 40°03'S 148°02'E, 19 Oct. 1985, *P. Collier 904* (HO); c. 1 km N of Mount Leventhorpe, Flinders Island, 40°04'S 148°05'E, 24 Sep. 1989, *P. Collier 4139* (HO); Devils Chimney, Cape Barren Island, 40°20'S 148°8'E, 9 Oct. 1988, *P. Collier 3588* (HO); Cape Barren Island, 40°25'S 148°15'E, 22 Oct. 1844, *J. Milligan 619* (HO *4949*); NORTH WEST: Machinery Creek, Cethana, 41°29'S 146°9'E, 13 Sep. 1992, *A.M. Buchanan 12639* (HO); Gog Range, near top of range, 41°30'S 146°23'E, 26 Oct. 1997, *A. Aliano* (HO *322892*); MIDLANDS: Dazzler Range, Kerrisons Road, 1.5 km SE from junction with Asbestos Road, 41°10'S 146°42'E, 19 Jan. 1989, *F.E. Davies 1069* and *P. Ollerenshaw* (AD, HO, MEL); NORTH EAST: Road from Diddleum Plains to Ringarooma, 41°20'S 147°38'E, Dec. 1968, *M. Burns 704* and *T.E. Burns* (HO); Near Sloop Lagoon, Bay of Fires [c. 14km N of St Helens], 41°12'S 148°16'E, Sep. 1990, *E.B. Clayton* (HO *127095*); BEN LOMOND: Blue River, Blue Tier 41°13'S 147°57'E, Oct. 1879, *A. Simson 1571* (HO); EAST COAST: Organ Hill, near Bicheno, 41°47'S 148°11'E, 20 Mar. 1980, *A. Moscal 193* (CANB, HO); Snow Hill (SH 041 E) plateau, 41°55'S 147°50'E, 06 Oct. 1999, *B. French 323* (HO); Mt Amos, 42°10'S 148°18'E, 19 Sep, *W.M. Curtis* (HO); Gates Bluff heaths, Freycinet Peninsula, 42°13'S 148°20'E, 29 Dec. 1987, *A.M. Buchanan 10670* (HO); Southern end of Freycinet Peninsula, 42°17'S 148°18'E, 06 Jul. 1985, *P. Collier 625* (HO); Schouten Island, 42°18'S 148°18'E, Apr. 1925, *L. Rodway 117* (HO); CENTRAL HIGHLANDS: Mount Roland, S of Sheffield, 41°28'S 146°16'E, 27 Oct. 1974, *D.A. Ratkowsky 1307* and *A.V. Ratkowsky* (CANB, HO, MEL); Mount Vandyke, 41°30'S, 146°13'E, 21 Apr. 1985, *P. Collier 411* (HO).

Typification: The labels for the sheets K *278731* and K *278732* do not include information on the collector though they are in Gunn's handwriting. Gunn did not collect from either Cape Barren Island or Schouten Island (Buchanan 1988, 1990). Milligan did collect from Schouten Island (Buchanan 1988) and it is probable that the lectotype chosen here was made by Milligan. Milligan also collected on both Flinders and Cape Barren Islands in October and November of 1844 (Buchanan 1988, 1990; HO *4944*) and it is probable that the specimens K *278732*, HO *4944* and MEL *4626* are part of that gathering.

Distribution and ecology: *Leiotenia bilobum* subsp. *truncatum* is found on Flinders and Cape Barren Islands (Furneaux Group) and in northern and eastern regions (including some near shore islands) of the island of Tasmania. It is found in rocky, usually granitic, areas in woodland, shrubland and heath.

Conservation status: This subspecies is widespread, found in several reserves (eg. Dazzler Range and Freycinet National Parks) and appears to be secure.

4. *Leionema bilobum* subsp. **serrulatum** (F.Muell.) Duretto & K.L.Durham, *stat. & comb. nov.*; *Eriostemon serrulatus* F.Muell., *Fragm.* 1: 4 (1858). Type: **VICTORIA:** EASTERN HIGHLANDS: Bunip-Bunip Creek, Victoria, *F.Mueller* (holo: MEL *4620*; iso: K *278728*, images HO *532029* & MEL, MEL *4622*).

Leionema bilobum subsp. 3 (West Gippsland), *fide* Ross and Walsh (2003).

Dense *shrub* or small tree to 4 m high, often suckering from roots; hairs with rays to 0.25 mm long. *Leaves* narrowly elliptic-oblong or oblong, 16–52 mm long, 4–8 mm wide, longest leaf (30–)36–52 mm long, leaf length : leaf width 4–7, margins serrate, apex slightly truncate or retuse, base more or less cuneate or attenuate. *Pedicels* 2–7 mm long, with a sparse to moderately dense pubescence. *Sepals* c. 0.5 mm long, abaxial surface with scattered stellate hairs. *Petals* white, sometimes with a faint pink blush, 4–5 mm long. Flowering Sept.-Nov.; fruiting Nov.-Jan. (Fig. 1g).

Selected specimens seen: **VICTORIA**: EASTERN HIGHLANDS: O'Shannessy Catchment, Track #5. 6.5 km due S from Mt Grant, 37°36'S 145°49'E, S29, 6 Nov. 1985, *N.G. Walsh 1493* (CANB *n.v.*, MEL); Upper Yarra Water Catchment, S40, 24 Nov. 1982, *A.C. Beauglehole 71720 and C.M. Beauglehole* (MEL); 3 miles W of Mt Gregory, upper Yarra Catchment, Fehring Ck area, S40, 37°42'S 146°05'E, 21 Oct. 1980, *S.J. Forbes 947* (MEL); E of Warburton on Lay Track at its crossing of Mississippi Creek, S38, 37°46'S 145°47'E, 22 Sep. 1983, *M.G. Corrick 8635* (HO, MEL, NSW); near Mt Baw Baw, 1 Apr. 1958, *J. Galbraith ACB7232* (MEL); Seven Acre Creek, 4.5km SSE of Powelltown, 37°52'S 154°45'E, 16 Oct. 1987, *D.E. Albrecht 3312* (BRI *n.v.*, CANB *n.v.*, HO, MEL); Bunyip State Park, Tomahawke Gap, 37°54'S 145°40'E, 20 Nov. 1997, *C.M. Edwards 31* (MEL); Rysons Creek, N of Labertouche, Oct. 1973, *J.H. Seebeck* (MEL *693016*); c. 5 miles [8 km] N of Labertouche, on Tea Tree Road, 2 Oct. 1960, *T.B. Muir 1283* (HO, MEL, NSW); GIPPSLAND HIGHLANDS: Grand Ridge Road, 1 km W of Dingoes Creek Road, 19 km NNE of Foster P.O., T33, 21 Dec. 1978, *A.C. Beauglehole 63003* (MEL).

Distribution and ecology: *Leionema bilobum* subsp. *serrulatum* is found in southern parts of the Eastern Highlands and the Gippsland Highlands, Victoria. It usually grows in wet schlerophyll forest or riparian open forest, often on steep slopes. The taxon actively reproduces from suckering and can form dense stands.

Conservation status: Ross and Walsh (2003) considered this taxon to be rare.

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References

Bentham, G. (1863). *Flora Australiensis, Vol. 1.* Lovell, Reed and Co.: London.

Buchanan, A.M. (1988). *The Tasmanian Collecting Localities of Ronald Gunn and Joseph Milligan.* Tasmanian Herbarium Occasional Publication No. 1. Tasmanian Museum and Art Gallery: Hobart.

Buchanan, A.M. (1990). *Ronald Campbell Gunn (1808–1881).* In P.S. Short (Ed.), *History of Systematic Botany in Australasia.* pp. 179–192. Australian Systematic Botany Society Inc.

Durham, K.L. (1998). Morphological variation within *Leionema bilobum* (Rutaceae). Honours Thesis. The University of Melbourne.

Engler, A. (1931). *Rutaceae*. In A. Engler, and K. Prantl. (Eds) *Die Naturlichen Pflanzenfamilien*. pp. 248-57. Engelmann: Leipzig.

Hooker, J.D. (1855). *The botany of the antarctic voyage of H.M. discovery ships Erebus and Terror in the years 1839–1843, Part III Flora Tasman., Vol. I Dicotyledons*. Lovell Reeve: London.

Mitchell, T.L. (1848). *Journal of an Expedition into the Interior of Tropical Australia in search of a Route from Sydney to the Gulf of Carpentaria*. Longman, Brown, Green and Longmans: London.

Mueller, F.J.H. (1854). Definitions of rare or hitherto undescribed Australian Plants collected within the boundaries of the Colony of Victoria. *Transactions of the Philosophical Society of Victoria* **1**, 5–24.

Mueller, F.J.H. (1858). *Fragmenta Phytographiae Australiae* **1**, 4.

Ross, J.H. and Walsh, N.G. (2003). A Census of the Vascular Plants of Victoria, 7th Edition. Royal Botanic Gardens Melbourne: Melbourne.

Willis, J.H. (1957). Vascular flora of Victoria and South Australia. *The Victorian Naturalist* **73**, 188–197.

Wilson, P.G. (1970). A taxonomic revision of the genera *Crowea, Eriostemon* and *Phebalium* (Rutaceae). Nuytsia **1**, 5–155.

Wilson, P.G. (1998). New species and nomenclatural changes in *Phebalium* and related genera (Rutaceae). Nuytsia **12**, 267–288.

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A Conspectus of the Western Australian Bossiaea species (Bossiaeeae: Fabaceae)

J. H. Ross

National Herbarium of Victoria, Royal Botanic Gardens, Birdwood Avenue, South Yarra 3141, Australia.

Abstract

An overview is provided of the Western Australian species of *Bossiaea*. Thirty-eight species are recognised of which the following are described here as new: *B. arcuata*, *B. atrata*, *B. aurantiaca*, *B. barbarae*, *B. barrettiorum*, *B. calcicola*, *B. celata*, *B. crenaea*, *B. flexuosa*, *B. inundata*, *B. laxa*, *B. saxosa*, *B. simulata* and *B. smithiorum*. Descriptions, distribution maps, and a key to identification are provided and most species are illustrated. Attention is drawn to a number of entities whose taxonomic status awaits clarification.

Lectotypes are selected for *B. concinna* Benth., *B. dentata* (R.Br.) Benth. var. *latifolia* Benth., *B. dentata* var. *hastata* Benth., *B. disticha* Lindl., *B. divaricata* Turcz., *B. eriocarpa* Benth., *B. eriocarpa* var. *eriocalyx* Benth., *B. eriocarpa* var. *planifolia* Domin, *B. gilbertii* Turcz., *B. lalagoides* F.Muell., *B. linophylla* R.Br., *B. nervosa* Meisn., *B. ovalifolia* Endl., *B. oxyclada* Turcz., *B. peduncularis* Turcz., *B. preissii* Meisn., *B. rigida* Turcz., *B. sulcata* Meisn., *B. walkeri* F.Muell., *B. webbii* F.Muell., *Lalage acuminata* Meisn., *L. augustifolia* Meisn., *L. hoveifolia* Benth., *L. ornata* Lindl., *L. stipularis* Meisn., *Platylobium spinosum* Turcz., *Scottia augustifolia* Lindl., *S. dentata* R.Br. and *S. laevis* Lindl. A neotype is selected for *B. leptacantha* E. Pritz.

Introduction

The genus *Bossiaea*, as presently understood, is represented in Western Australia by thirty-eight species, more species than occur in the remainder of Australia. Of the species found in Western Australia, only *B. bossiaeoides* (A.Cunn. ex Benth.) Court and *B. walkeri* F.Muell. occur in an adjacent state or territory or beyond. The majority of Western Australian species occur in the south-west where they occupy a diversity of habitats. Many species are conspicuous, and sometimes locally dominant, members of heathland and eucalypt-dominated woodland and forest, but some occupy fairly hostile environments.

Several species are associated only with salt lake systems where they typically occur on the perimeter of lakes above the samphire zone, or on islands or spits of land that protrude into the salt-affected areas. In years of severe drought some of these species associated with hostile environments produce no flowers, and the outer stems die back from the perimeter of the plant towards the centre. When favourable conditions return, new stems are produced from the centre of the plant.

Bossiaea Vent. is the largest genus in the endemic papilionoid tribe *Bossiaeeae* (Benth.) Hutch. which comprises also *Platylobium* Sm., *Goodia* Salisb., *Ptychosema* Benth., *Muelleranthus* Hutch. and *Aenictophyton* A.T.Lee (Ross & Crisp, 2005). *Bossiaea* and *Platylobium*, which until now have been maintained as separate genera, are differentiated from other members of the tribe *Bossiaeeae* by having the flowers 1-several from the axils or occasionally pseudoracemose and subtended by papery or scarious bracts, and the leaves simple, unifoliolate (i.e. with 2 pulvini, one at the base of the petiole and one at the top below the leaflet) or reduced to exstipulate scales. *Bossiaea* and *Platylobium* both have distichous phyllotaxis. *Platylobium* has been

differentiated traditionally from *Bossiaea* on the basis of having the pod adaxially winged, with thin elastically revolute valves, a base chromosome number of n=8 (n=9 in *Bossiaea*) and the two upper calyx lobes enormously expanded relative to the three lower teeth. However, this latter character is not unique to *Platylobium*. The two upper calyx-lobes in *B. cucullata* J.H.Ross are also greatly enlarged relative to the lower three. *Bossiaea spinosa* (Turcz.) Domin has similarly enlarged upper calyx lobes although, unlike the situation in *Platylobium*, in *B. spinosa* the two lobes are free on the upper side almost to the base. A recent study of the Mirbelieae and Bossiaeeae (Crisp and Cook, 2003) found that *Platylobium formosum* Sm. nested with the two *Bossiaea* species in the study. A more comprehensive unpublished molecular study casts doubt on the ability to maintain both genera, all four species of *Platylobium* being found to nest amongst species of *Bossiaea*. The rules of priority dictate that when united the correct name for the combined genus is *Platylobium*, unless steps are taken to try and conserve *Bossiaea* over *Platylobium*. Such a proposal has been made (Ross, 2004).

The last comprehensive treatment of the Western Australian *Bossiaea* species was contained in Bentham's account of the genus in *Flora Australiensis* (1864). Bentham recognised three Series within *Bossiaea,* all of which are represented in Western Australia. Bentham characterised his series as follows:

Series I. **Oppositifoliae**–Leaves opposite. Calyx upper lobes obtuse. Pods glabrous, exserted, on a long stipe. Three Western Australian species are in this series.

Series II. **Eriocarpae**–Leaves alternate. Calyx upper lobes acuminate, acute or mucronate. Ovary very hairy. Pod nearly sessile, hairy. Five Western Australian species are in this series.

Series III. **Normales**–Leaves alternate [or reduced to scales]. Calyx upper lobes rounded or truncate. Ovary glabrous or ciliate on the edge. Pod sessile or stipitate, glabrous. The majority of Western Australian species are in this series.

The large increase in the number of species unknown to Bentham has tended to blur the distinction between the series Eriocarpae and Normales. Nevertheless, some of the characters used by Bentham are useful in distinguishing groups of species within his series Normales. No formal infrageneric classification is proposed here pending the completion of an account of the entire genus. As completion of a systematic revision of the entire genus is still some way off, this opportunity is taken to present a conspectus of the western species.

Materials and Methods

Descriptions were based on a study of herbarium collections from AD, CANB, K, LD, MEL, NY, PERTH and W supplemented by field studies. Measurements of vegetative and fruit characters were taken from dried herbarium material; those of floral characters from material preserved in spirit or from material rehydrated by boiling briefly in water. Only selected specimens are cited for most species, and specimens of each taxon are cited in the chronological order in which they were collected. Botanical regions employed are those defined by Beard (1980).

The Department of Conservation and Land Management (CALM) Conservation Codes for Western Australian Flora and their definitions are given in each number of *Nuytsia*, the journal of the Western Australian Herbarium.

Morphological characters of taxonomic significance

Some of the diagnostic characters used in the key to distinguish species and groups of *Bossiaea* species are discussed briefly:

Flowers

The flowers in the majority of species are typically papilionoid and held with the standard petal facing perpendicularly and prominently displayed like a banner. In most species the flowers are essentially yellow and red, although in some species there are elements of pink, purple, burgundy, brown or green, and they are insect-pollinated. In four species (*B. cucullata*, *B. dentata*, *B. preissii* and *B. walkeri*) the flowers are pendulous, the apex of the standard pointing downwards towards the ground. In three of these species (*B. cucullata*, *B. dentata*, *B. walkeri*) the standard and wing petals are reduced in size and the keel petals are elongated and typically pink, red or burgundy which suggests that they are adapted for pollination by birds.

Inflorescences are axillary. The flowers are pedicellate and either solitary, in sessile clusters or pseudoracemose. *Bossiaea peduncularis* and *B. arcuata* are unusual in having the flowers typically inserted some distance above the axils.

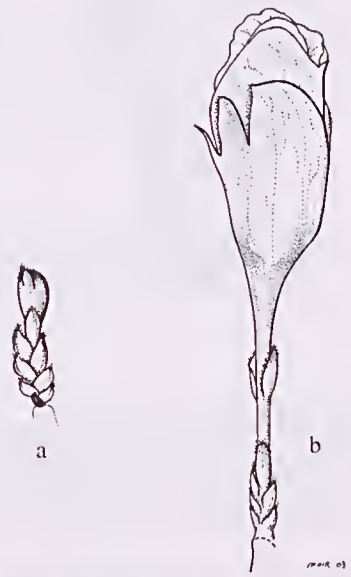

Figure 1. *Bossiaea leptacantha* – a, very young flower bud showing basal imbricate bracts concealing the pedicel and an apical bracteole (one of a pair) overlapping the base of the calyx, × 8; b, older bud showing the basal imbricate bracts (the most basal bract removed) some distance below the paired bracteoles which are carried upwards away from the bracts as the pedicel elongates, × 8. a and b from B. Archer 1415.

Bracts and bracteoles

The flowers in *Bossiaea* are subtended by a series of structures (bracts and bracteoles) that are usually brown and papery, scarious, or at times coriaceous and rigid (Fig. 1a). The bracts and bracteoles are similar in shape and size or dissimilar, and the paired bracteoles are either caducous or persist until at least the young pods develop. Usually the bracts and bracteoles are clearly differentiated by position and/or by size or shape. The paired bracteoles are the uppermost structures on the pedicel. In those species where the bracteoles persist, there is usually no difficulty in differentiating between the bracts and bracteoles as the bracteoles are carried upwards away from the basal bracts as

the pedicel lengthens, and they often differ slightly or markedly in shape or texture from the basal bracts (Fig. 1b). The number of basal bracts varies from one to many (13).

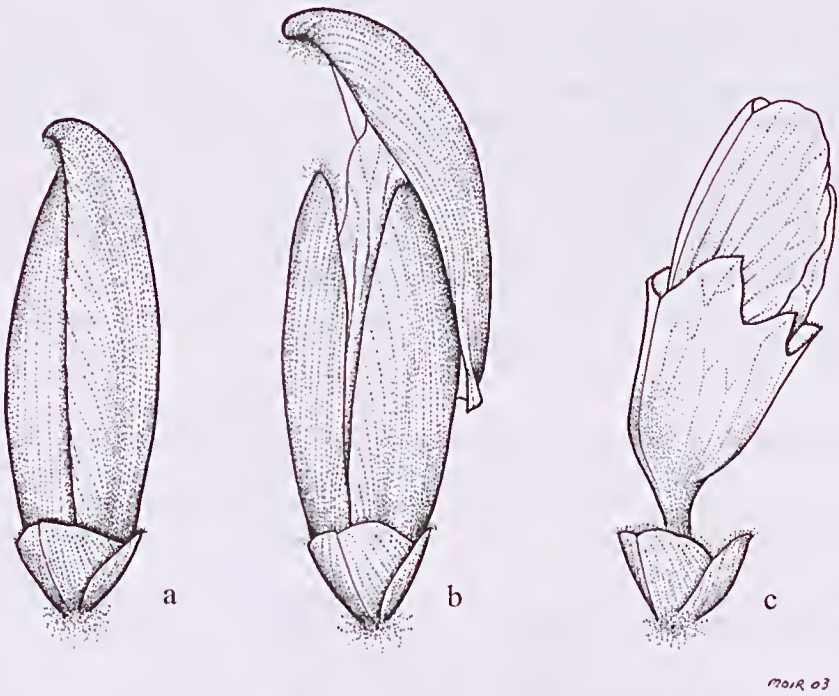

Figure 2. *Bossiaea aquifolium* subsp. *laidlawiana* – a, very young flower bud showing the two cupular basal bracts and the large inner cucullate bract (right) overtopping the bracteoles, × 8; b, large inner bract in the process of being shed to expose the two large bracteoles, × 8; c, older flower bud revealing the calyx and corolla following the shedding of the large inner bract and two bracteoles, ×8. a–c from *Corrick 9233*.

In some species, for example *B. webbii*, *B. aquifolium*, *B. dentata*, *B. pulchella* and *B. ornata*, the uppermost structures on the pedicel are usually rapidly caducous, often well before the flower buds expand fully and are only evident in very young buds. In these above-named species, the three uppermost elliptic rigid structures on the pedicel are much larger than, and differ in shape from, the paired basal bracts (Fig. 2). The outer of these three upper elliptic rigid structures in these species is the largest, in young bud is attached near the base of the calyx, covers the three lower calyx lobes, is cucullate apically, and envelopes the two inner structures. The two inner structures are attached in young bud near the base of the calyx almost opposite but above the point of attachment of the larger outer structure. These two inner structures almost overlap each other basally in bud, partially overlap each other for much of their length, and cover the two upper calyx lobes. Apart from being a little smaller, the two inner structures are scarcely differentiated from the outer one. Once the flower buds have developed, and after the basal bracts have been removed by dissection, the two inner structures are found to be attached almost opposite each other at the base of the calyx. These three elliptic structures are invariably rapidly caducous. The outer falls off first sometimes taking the

inner two with it. The two uppermost elliptic structures are interpreted as bracteoles, and the third larger structure that envelops the bracteoles, together with the cupular structures at the base of the pedicel, are interpreted as bracts. The upper bract in these species differs significantly in shape and in size from the basal bracts.

In some species the paired bracteoles are consistently caducous and in others consistently persistent. When this consistency prevails, it is sometimes a useful diagnostic character to differentiate allied taxa. However, when this character is labile and both states occur within a species, the character loses its utility even although there may be a tendency for one of the states to predominate.

Calyx

There is considerable variation in the shape of the lobes and in the degree of lobing of the calyx. Typically the two upper calyx-lobes are slightly enlarged relative to the three lower lobes and are united for a greater proportion of their length than are the lower three. However, in some species (*B. spinosa*, *B. cucullata*) the two upper lobes are greatly enlarged relative to the lower three. The calyx of *B. spinosa* is reminiscent of the calyx in species of *Platylobium* except that the two upper lobes are free almost to the base on the upper side. In some species such as *B. ornata*, all five lobes are more or less the same size and shape and are divided almost to the base of the calyx.

Keel petals

The keel petals are either glabrous apically in the sinus at the junction of the two opposing keel petals, or frequently a dense white woolly indumentum is present. The presence or absence of this woolly indumentum is a useful character to differentiate groups of species.

Ovary

The presence or absence of indumentum on the ovary, and the nature of the indumentum when present, is important and often diagnostic. The ovary may be entirely glabrous, glabrous apart from hairs along one or both marginal sutures and sometimes with a few additional hairs on the surface of the valves towards the apex, densely villous throughout, or densely villous except for an absence of hairs along the lateral margins.

Leaves

In mature plants leaves are generally either present and stipulate or absent and reduced to exstipulate scale leaves. Mature plants of the majority of species are leaf-bearing and obviously so, but in some species such as *B. arcuata* and *B. eremaea,* the leaves are few in number, relatively inconspicuous, typically confined to the young growth and often rapidly caducous so that when viewed in the field from a short distance the plants appear to be leafless. In the field these two species superficially resemble some of the leafless species and may be mistaken for them. However, the presence of stipules on the branchlets of these species indicates that they are leaf-bearing species.

The situation is complicated by the occasional occurrence in some of the leafless species, for example *B. flexuosa* and *B. oxyclada*, of a few leaves on very young growth usually at the base of a plant or arising from lateral subterranean roots. Examination of these young shoots reveals near the base of the shoot the presence of paired stipules that are laterally confluent with the petiole at each node (Fig. 3a). However, production of a

leaf lamina is suppressed towards the apex of the shoots and at each node a linear terete or subterete appendage is produced between the paired stipules that is interpreted as a rudimentary petiole (Fig. 3b). This gives rise to a very distinctive 'trifid' arrangement. On mature stems of the same plants that bear this distinctive young growth, broadly ovate scale leaves develop at the nodes that are usually undivided apically, although sometimes they split at the apex and resemble paired stipules (Fig. 3c and d).

Figure 3. *Bossiaea flexuosa* – a, very young shoot arising from base of plant showing a leaf and laterally confluent stipules at each node except at the extreme apex of the shoot, × 1; b, apex of shoot showing a leaf developing in the axil of the stipules (lower left) and the upper nodes with the leaf reduced to a linear terete or subterete appendage to produce the 'trifid' arrangement, ×4; c, mature leafless twig showing the ovate scale leaves at the nodes, ×1; d, apex of young growth showing the scale leaves, ×4. a–c from *Ross 4048 & B. Archer*

Bossiaea praetermissa is a species that may confuse. It is a leaf-bearing species, the leaves usually occurring on the young growth either on the apical shoots or at the base of the plant, but some mature plants may be leafless. Examination of the stems will reveal the presence at a node of paired stipules and the frequent occurrence of a linear terete or subterete appendage (the 'trifid' arrangement referred to above) (Fig. 4). Mature plants of *B. rufa* R.Br. are occasionally leafless, but, unlike *B. praetermissa*, the linear terete or subterete appendages are absent. Given the potential for confusion, in the

key to identification *B. praetermissa* and *B. rufa* are also keyed out under the leafless species.

The description of leaf venation follows the terminology of Hickey (1973).

Figure 4. *Bossiaea praetermissa* – a, young stem showing attachment of leaf, × 1; b, leaf (lower left) arising in the axil of the stipules and the upper leaf (right) reduced to a linear terete appendage to produce the distinctive 'trifid' arrangement, × 4. a and b from *Corrick 9527*

Spines

A number of leaf-bearing species bear abbreviated lateral shoots which in many species terminate in a pungent point. These species are referred to as 'spinescent'. The presence of pungent-pointed lateral shoots is a useful diagnostic character and assists to group species. Some caution is required, however, as the abbreviated lateral shoots in some species have blunt rather than sharp points and the distinction between the two is not absolute so confusion is possible. None of the opposite-leaved species has abbreviated lateral shoots.

The spinescent species may be divided into two broad groups on the basis of the degree of pubescence of the ovary. *Bossiaea spinosa* and *B. divaricata* have ovaries that are densely villous throughout, whereas in the remaining spinescent species the ovaries are glabrous throughout or have scattered hairs along one or both sutures and sometimes on the surface of the valves, especially apically.

Species delimitation among some of the spinescent species in which the ovaries are glabrous or almost so is difficult. Two options present themselves as the basis for dividing these species into two groups. The species may be grouped according to whether the bracteoles on the pedicels are caducous or persistent, or, alternatively, according to whether the young branchlets are glabrous or almost so, or sparingly to densely clothed with appressed to slightly spreading hairs. Although the bracteoles in most species are usually either caducous or persistent, the presence of both character states in some species, for example *B. spinescens* Meisn., reduces the utility of this character in those species. Consequently, it was considered better to group the species on the basis of the presence or absence of hairs on the young branchlets, even although this character too has its limitations. The species with pubescent young growth differentiate from one another quite readily, but some of the species with glabrous young growth are difficult to differentiate. Among this latter group of species, *B. preissii* is the only one with pendulous flowers and keel petals about as long as the standard, and *B. arcuata* is easily recognised because the leaves are few, inconspicuous, and superficially apparently absent so that in the field from a short distance the plants appear to be leafless.

General

Some species such as *B. eriocarpa* and *B. ornata* are polymorphic and the variation within each is complex and difficult to accommodate formally. A number of entities are not well understood or circumscribed and their taxonomic status awaits clarification. I am not in a position to resolve these difficulties but, by drawing attention to their existence, hope that future workers will address them.

Taxonomy

Bossiaea Vent., *Descr. Pl. Nouv.* 1, 7 (1800); Benth., *Fl. Austral.* 2: 154-168 (1864)

Type: *B. heterophylla* Vent.

Scottia R. Br. in W.T.Aiton, Hortus Kew. edn 2, 4: 268 (1812)

Type: *S. dentata* R. Br.

Lalage Lindl. in Edwards's, Bot. Reg. 20: t. 1722 (1834)

Type: *L. ornata* Lindl.

Shrubs, subshrubs or sometimes small trees; branches terete to oval in section, angled, flattened or distinctly winged, unarmed or short lateral branches sometimes terminating in pungent points. Leaves usually alternate, simple or more commonly unifoliolate, sometimes opposite or reduced to small exstipulate ovate scales and plants apparently leafless; stipules usually small and inconspicuous. Inflorescence axillary. Flowers 1-few, occasionally pseudoracemose by suppression of leaves, pedicellate, usually subtended by a series of brown or reddish-brown, distichous, papery or rigid bracts and bracteoles, the bracts and bracteoles usually not or scarcely differentiated; bracteoles paired, small or large, persistent or caducous; 2 upper calyx lobes usually broader and larger than the lower 3; standard longer than to much shorter than the keel; staminal sheath split open on upper side; anthers uniform, dorsifixed, with a broad connective. Pods sessile or stipitate, ± flattened, the upper suture not winged but often thickened; valves separating, not or only slightly revolute, several-seeded; seeds plump, with a small hilum and a hooded cap-like aril.

A widespread endemic Australian genus of about 65 species. Absent from central Australia.

Key to species

1. Leaves in mature plants opposite, stipulate 2
1. Leaves in mature plants alternate or sometimes appearing fascicled, stipulate, or leaves reduced to exstipulate scales and apparently absent 4

2. Standard petal shorter than the wing and keel petals; petals green, greenish-yellow, pale salmon to dull red or deep burgundy; flowers pendulous, the apex of the keel facing the ground; leaf lamina broadly ovate-cordate or triangular to hastate-lanceolate or almost linear ..... **3. *B. dentata***
2. Standard petal as long as or longer than the wing and keel petals; petals yellow and red; flowers not pendulous, the apex of the keel not facing the ground; leaf lamina semi-orbicular to semi-reniform, depressed ovate or broadly ovate 3

3. Leaf-lamina depressed ovate or broadly ovate to semi-orbicular, angular, margin pungent-pointed or denticulate, the midrib terminating in a pungent point ..... **2. *B. aquifolium***
3. Leaf-lamina semi-orbicular to semi-reniform, margin minutely denticulate, emarginate apically or midrib ending in a short mucro but not extending into a distinct pungent point ..... **1. *B. webbii***

4. Leaves in mature plants alternate or sometimes appearing fascicled, stipulate, occasionally leaves few, inconspicuous, mostly confined to the new growth and soon caducous; branches terete, oval and angled or occasionally flattened and/or winged but if so the leaves stipulate 5
4. Leaves in mature plants reduced to exstipulate scales; branches (cladodes) usually flattened and winged 30

5. Ovary densely villous throughout 6
5. Ovary glabrous throughout or with scattered hairs on one or both sutures and occasionally with a few scattered hairs on the surface of the valves 10

6. The 2 upper calyx-lobes obovate, greatly enlarged relative to the 3 lower lobes, free on the upper side almost to the base, about as long as the standard petal; leaf-lamina 2.3–6.0 mm long ..... **9. *B. spinosa***
6. The 2 upper calyx-lobes not obovate, not greatly enlarged relative to the 3 lower lobes and not free on the upper side almost to the base, much shorter than the standard petal; leaf-lamina (2.7–) 5–60 mm long 7

7. Prostrate spreading subshrub; standard petal 6 mm long ..... **7. *B.* sp. Frankland**
7. Erect shrub; standard petal 8–20 mm long 8

8. Abbreviated lateral shoots present and usually terminating in a pungent point; divaricately branched rigid shrub; petiole 0.3–0.6 mm long; 3 lower calyx-lobes 2.3–3.7 mm long, about as long as the calyx-tube ..... **8. *B. divaricata***

8. Abbreviated lateral shoots absent or, if present, not terminating in a pungent point; shrub not divaricately branched; petiole 0.8–4.0 mm long; 3 lower calyx-lobes 3.5–10 mm long, longer than the calyx-tube 9

9. Leaf-lamina 1.5–6.0 mm wide, typically narrow-oblong or linear; venation simple craspedodromous (secondary veins inserted almost at right angles to the midrib and all of the secondary veins and their branches terminating at the margin, the branches not joining adjacent veins before reaching the margin); apices of keel petals seldom fimbriate ..... **5. *B. eriocarpa***

9. Leaf-lamina (2-) 5–38 mm wide, typically ovate; venation semicraspedodromous (secondary veins branching just before they reach the margin and joining adjacent veins before one arm terminates at the margin); apices of keels invariably minutely fimbriate ..... **6. *B. ornata***

10. Keel petals glabrous or with occasional scattered hairs apically in the sinus 11

10. Keel petals densely woolly-pubescent apically in the sinus 14

11. Leaves distinctly ovate-cordate, the margins minutely and irregularly crenulate; the 2 outer basal bracts rigid, coriaceous, together almost cupular; pods scarcely longer than wide ..... **4. *B. pulchella***

11. Leaves not distinctly ovate-cordate, the margins entire; the 2 outer basal bracts not as above; pods distinctly longer than wide 12

12. Calyx glabrous apart from marginal cilia on the lobes; young branchlets terete to oval or slightly flattened but not winged, covered with a white waxy outer layer that rapidly exfoliates to reveal a pitted green inner layer; leaves usually confined to the young growth, mostly soon caducous and the plants superficially apparently leafless ..... **25. *B. cremaea***

12. Calyx sparingly to densely clothed with appressed to spreading hairs; young branchlets winged or not winged, lacking a white waxy outer layer that exfoliates to reveal a green inner surface; leaves persisting or caducous, sometimes plants almost leafless but then the young branchlets winged 13

13. Erect slender shrub; young stems terete or oval in section to slightly flattened, up to 2 mm wide, not incised at the nodes; leaf-lamina oblong, linear-oblong to obovate-oblong; stipules exceeding the petiole; flowers on pedicels 7–14 mm long ..... **13. *B. disticha***

13. Lax weak-stemmed shrub, the stems often sprawling and only erect when supported by surrounding vegetation; young stems flattened and winged, 1.5–7.0 mm wide, incised at the nodes; leaf-lamina rotund, obovate or obovate- to elliptic-oblong; stipules usually shorter than the petiole; flowers on pedicels 2–5 mm long ..... **27. *B. praetermissa***

14. Unarmed shrub, the abbreviated lateral shoots, if present, not terminating in a pungent point 15

14. Spineseent shrub, the abbreviated lateral shoots terminating in a pungent point 19

15. Calyx densely elothed with short spreading hairs; pedieels 2–5 mm long, elothed with short spreading hairs; leaves often absent at the nodes, the lamina represented by a linear terete or subterete appendage that extends beyond the two adjaeent stipules..... **27. *B. praetermissa***

15. Calyx glabrous or with seattered appressed hairs; pedieels (3–) 5–25 mm long, glabrous to densely pubeseent; leaf lamina not represented by a terete or subterete appendage..... 16

16. Lax weak-stemmed subshrub to 0.5 m high with wiry trailing or sprawling stems; stem extremities somewhat flattened and up to 2 mm wide..... ***10. B. modesta***

16. Shrub to 3 m high, stems not wiry, trailing or sprawling, or, if sprawling, flattened, winged and 1.5–10 mm wide..... 17

17. Keel petals suffused externally with red or dark red apieally or throughout; standard petal 6.6–12.2 mm long..... 18

17. Keel petals uniformly greenish-yellow; standard petal 12–16 mm long..... ***12. B. laxa***

18. Young stems oval in seetion to slightly flattened, up to 2 mm wide, not ineised at the nodes; ealyx glabrous or with seattered appressed hairs; pedieels sparingly to densely pubeseent; pods 0.9–1.7 em long..... ***11. B. linophylla***

18. Young stems flattened, winged, 1.5–10 mm wide, ineised at the nodes; ealyx glabrous; pedieels glabrous or sparingly pubeseent; pods (2.0) 2.5–3.8 em long..... ***26. B. rufa***

19. Flowers pendulous; standard petal (9.5–)13.0–17.4 mm long; keel petals about as long as the standard..... **18. *B. preissii***

19. Flowers not pendulous; standard petal up to 13.0 mm long; keel petals usually shorter than the standard..... 20

20. Young branehlets sparingly to densely elothed with appressed to spreading hairs; lower surfaee of leaves sparingly to densely elothed with straight appressed or erinkled slightly spreading hairs, seldom glabrous..... 21

20. Young branehlets glabrous or with oeeasional seattered hairs (apart from hairs at the apiees of braets in the leaf axils); lower surfaee of leaves glabrous or almost so..... 26

21. Pedieels filiform, 8–13 mm long, usually inserted well above the axils; keel petals pale greenish-yellow..... **14. *B. pedunicularis***

21. Pedieels slender to stout, 2.0–7.2 mm long, usually axillary; keel petals yellow, yellow and red, purple or pinkish-red..... 22

22. Calyx glabrous externally apart from hairs on the margins of the lobes 23
22. Calyx sparingly to densely pubescent externally 24

23. Bracteoles usually rapidly caducous and leaving 2 prominent raised opposite or subopposite scars on the pedicel; leaf-lamina oblong to narrowly obovate-oblong, (1.5–) 3–7 (–10) mm long, arching down on either side of the midrib, the margins slightly recurved or revolute to such an extent that only the midrib is visible below or the margins meeting and the lamina almost terete, with apex rounded or obtuse, not glaucous, upper surface shiny ..... **16. *B. smithiorum***
23. Bracteoles persisting; leaf-lamina obovate, slightly obtrullate, obovate-oblong, elliptic or oval, 1.2–3.9 mm long, usually flat to V-shaped in section, with apex often depressed-retuse, glaucous, upper surface not shiny ..... **17. *B. barbarae***

24. Leaf-lamina 1.1–4.0 mm wide, apex emarginate or truncate; young branchlets oval in section to flattened (confined to the coastal limestone plain and some off-shore islands) ..... **20. *B. calcicola***
24. Leaf-lamina 0.8–2.0 mm wide, apex rounded or depressed-retuse; young branchlets terete to oval in section and slightly angular (absent from the coastal limestone plain and off-shore islands, an inland species) 25

25. Leaf-lamina oblong or narrowly obovate-oblong, 0.8–1.4 mm wide, lamina sloping down on either side of the midrib so upper surface usually slightly convex in section, green, apex rounded, upper surface shiny ..... **24. *B. aurantiaca***
25. Leaf-lamina obovate, slightly obtrullate, obovate-oblong, elliptic or oval, 0.9–2.0 mm wide, usually flat to V-shaped in section, glaucous, apex rounded or depressed-retuse, upper surface not shiny ..... **17. *B. barbarae***

26. Leaves inconspicuous, few, confined to the young growth and caducous, the plants superficially apparently leafless ..... **15. *B. arcuata***
26. Leaves conspicuous, numerous, not confined to the young growth, not caducous, the plants obviously 'leafy' 27

27. Young branchlets oval in section to flattened and narrowly winged; petiole typically attached almost at right angles to the leaf-lamina (so that the lamina tends to be held in a different plane to the petiole) ..... **19. *B. spinescens***
27. Young branchlets terete to oval in section and angled but not flattened and narrowly winged; petiole not attached almost at right angles to the base of the leaf-lamina 28

28. Calyx and pedicels dark red or purplish; leaf-lamina flat or V-shaped to almost conduplicate ..... **23. *B. atrata***
28. Calyx and pedicels green or suffused with red or pinkish-red; leaf-lamina flat or convex in section (sloping down on either side of the midrib) 29

29. Pedicels filiform, 3.5–11.0 mm long, usually longer than the leaves; leaves 1.0–1.3 (–1.6) mm wide, glaucous; compact dense intricately branched shrub (plants occur on or near the perimeter of salt lakes) ..... **21. *B. concinna***

29. Pedicels stout, 2.0–5.0 mm long, shorter than, as long as, or just exceeding the leaves; leaves 1.2–2.0 (–3.5) mm wide, not glaucous; open shrubs with many slender sparingly branched stems arising from the base (plants confined to the Murchison River gorge) ..... **22. *B. inundata***

30. Ultimate cladodes very broadly winged, 10–65 mm wide, wings incised at the nodes, the lobes projecting laterally or forwards and usually with an acute pungent apex ..... **29. *B. bossiaeoides***

30. Ultimate cladodes winged or scarcely winged, 1–10 mm wide, when present wings incised at the nodes but lobes lacking an acute or pungent apex 31

31. Flowers pendulous; standard much shorter than the keel petals; keel petals 13.5–26.0 mm long 32

31. Flowers not pendulous, the standard petal facing perpendicularly like a banner; standard as long as or longer than the keel petals; keel petals 6–12 mm long 33

32. Bracteoles caducous, basal; pedicels glabrous or almost so; standard 18–19 mm long, uniformly red or salmon-pink (rarely yellow) externally or occasionally suffused with orange ..... **30. *B. walkeri***

32. Bracteoles persistent, attached towards the middle of the pedicel; pedicels pubescent below the braeteoles; standard 10–14.4 mm long, deep yellow or orange-yellow externally and sometimes suffused with dark red or purple apically ..... **31. *B. cucullata***

33. Ovary glabrous or with scattered hairs along one or both sutures and occasionally also with scattered hairs on the surface of the valves 34

33. Ovary densely pubescent throughout or densely pubescent except along the lateral margins 40

34 Bracteoles rapidly caducous 35

34. Bracteoles persistent until at least the young pods start to develop 36

35. Ultimate branches of cladodes 0.7–2.2 mm wide; keel petals pale greenish-yellow throughout or sometimes with a reddish-brown longitudinal striation towards the lower margin and more or less parallel to it; standard yellow internally with a reddish-brown throat from which red-brown striations radiate into the lamina (favours deep sand above the samphire zone near the perimeter of salt lakes) ..... **33. *B. halophila***

35. Ultimate branches of cladodes 1.5–10.0 mm wide; keel petals green basally, dark red apically; standard deep orange-yellow internally with a deep purplish-red or reddish-pink basal horseshoe-shaped flare around a yellow throat (favours moist situations or amongst rocks along streams and near swamps) ..... **26. *B. rufa***

36. A linear terete or subterete appendage present in the axil of the scale leaves [stipules] at each node ..... **27. *B. praeternissa***

36. A linear terete or subterete appendage absent from the axil of the scale leaves at each node 37

37. Ovary with coarse hairs along each suture; calyx sparingly to densely clothed with appressed or spreading hairs ..... **35. *B. saxosa***

37. Ovary glabrous; calyx glabrous throughout apart from hairs on the margins of the lobes or with occasional scattered hairs 38

38. Standard petal externally yellow throughout or with faint red longitudinal striations radiating from the base; keel petals yellow or greenish-yellow (absent from Fitzgerald River National Park) 39

38. Standard petal externally red or reddish-brown with yellow longitudinal striations radiating from the base; keel petals deep red (confined to the Fitzgerald River National Park) ..... **34. *B. oxyclada***

39. Low compact dense spreading shrub to 0.5 m high; ultimate branches of cladodes terete to oval in section or slightly flattened, 1.0–1.5 mm wide, scarcely or narrowly winged; pods 1.5–2.4 cm long (occurs in southern WA from Peak Charles eastwards to Madura) ..... **...32. *B. leptacantha***

39. Lax spreading or semi-prostrate shrub to 0.7 m high; ultimate branches of cladodes flattened, 0.7–8.3 mm wide, winged; pods 2.7–4.8 cm long (confined to the Kimberley) ..... **28. *B. barrettiorum***

40. Bracteoles usually rapidly caducous; ovary densely pubescent throughout ..... **38. *B. celata***

40. Bracteoles persistent at least until the young pods develop; ovary densely pubescent except along the lateral margins 41

41. Branches distinctly flexuose; calyx densely clothed with appressed or spreading hairs 0.3–0.5 mm long; keel petals greenish-yellow basally, deep pinkish-red apically ..... **36. *B. flexuosa***

41. Branches not or occasionally slightly flexuose; calyx densely clothed with appressed or slightly spreading hairs up to 0.3 mm long; keel petals pale greenish-yellow throughout or orange-red basally ..... **37. *B. simulata***

1. *Bossiaea webbii* F.Muell., *Chem. & Drug. Australas.* 5: 56 (1882). *Type*: Darling Distr., 'On the summit of Mt Lindesay [Lindsay], near King George' Sound', 1882, *W. Webb* 62; lecto.: MEL *690320* (here selected); isolecto.: K, PERTH.

Slender shrub to 2.6 m high; stems often erect and arching outwards; branchlets terete, slender, usually glabrous but occasionally sparingly pubescent, sometimes fairly conspicuously lenticellate. Leaves opposite, unifoliolate; lamina semi-orbicular to semi-reniform, 0.3–1.8 cm long, 0.5–2.4 cm wide, wider than long, with margin copiously

minutely denticulate, emarginate apically or the midrib ending in a short muero but not extended into a distinct pungent point, usually glabrous throughout, rarely with scattered hairs on the midrib, with venation simple craspedodromous; petiole 0.7–1.3 mm long, glabrous or with a few basal hairs. Stipules broadly triangular, 0.5–0.7 mm long, 0.3–0.7 mm wide, shorter than the petiole, persisting, with margins ciliate. Flowers solitary or in pairs, with basal braets attached 0.5–1.5 mm above the base of the pedicel, with the pedicel pubescent below the braets, glabrous above; the 2 outer basal braets rigid, coriaceous, longitudinally striate, pubescent basally and with marginal cilia, sometimes with scattered hairs along the midline, persistent, dissimilar, together almost cupular, with the outer bract broadly ovate, 1.5–3 mm long, 1.6–2.5 mm wide, concave, the inner encircling the pedicel and the opposing lateral margins overlapping each other basally, broadly ovate, oblique, 1.5–2.8 mm long, 2.8–4 mm wide; the innermost and largest bract elliptic, 6–10 mm long, rigid, coriaceous, longitudinally striate, with margins conspicuously ciliate and internally woolly-pubescent apically, cucullate apically, enveloping the two inner bracteoles, rapidly caducous; bracteoles similar to the innermost bract but slightly smaller, 5.5–8.0 mm long, caducous. Calyx glabrous externally throughout except for marginal cilia on the lobes; 2 upper lobes 1.0–1.9 mm long excluding the tube 2.7–4.0 mm long, with lobes rounded-truncate and only slightly emarginate apically, with 3 lower lobes 0.7–1.2 mm long, obtuse, shorter than the tube. Standard more or less orbicular, 12.5–14.5 mm long including a basal claw 3–3.5 mm long, 12–16.5 mm wide, longer than the keel, emarginate apically, orange-yellow internally with a red flare on either side of a deep yellow throat, externally purplish-brown basally with red striations radiating into the orange-yellow margin; wings 9.5–14.2 mm long including a basal claw 2.0–3.4 mm long, auricled, 2.4–3.4 mm wide, usually longer than the keel, externally pinkish-red basally passing to brown and then yellow apically; keel 9.5–12.5 mm long including a claw 2.5–3.3 mm long, auricled, 3.5–4.5 mm wide, externally greenish-white basally passing to pinkish-red and then deep red apically, glabrous apically. Stamen-filaments 8.2–12.5 mm long. Ovary 4.7–5.5 mm long, on a stipe 2.6–3.0 mm long, 2–4-ovulate, glabrous. Pods held erect, on a stipe about as long as the calyx-tube, oblong to oblong-elliptic, 1.1–2.1 cm long, 0.75–1.0 cm wide, with valves thickened along the upper suture, conspicuously transversely venose, glabrous. Seeds ellipsoid, 3–3.5 mm long, 1.6–2.0 mm wide, pale brown (Fig. 5).

Distribution and habitat: Restricted to the Warren and Menzies subdistricts of the Darling Botanical District of the Southwestern Botanical Province where it occurs from near Mt Johnston and Mt Pingerup NNW of Walpole eastwards towards Mt Frankland and southwards to the vicinity of Walpole, with an eastern outlier on Mt Lindesay. A large disjunction apparently separates the Mt Lindesay population from the other more western populations (Fig. 6). Recorded from brown sandy loam or laterite in open Jarrah (*Eucalyptus marginata* Sm.), Karri (*Eucalyptus diversicolor* F.Muell.) or Jarrah and Marri (*Corymbia calophylla* (Lindl.) K.D.Hill & L.A.S.Johnson) forest and from white or grey sand in low-lying heathy-*Eucalyptus-Banksia* woodland. Flowers mainly Sept.–Oct., a few flowers produced as late as early December.

Representative specimens (30 examined): 27 km along Mt Frankland Rd from South Western Hwy, 18 Sept.1966, *E.M. Bennett 1186* (PERTH); South Western Hwy, 4 km W of Walpole, 19 Sept.1983, *J. Taylor 1986 & P. Ollerenshaw* (AD, CANB, MEL, PERTH); South Western Hwy, 6 km N of Inlet River, 14 Oct.1985, *J.H. Ross 3003* (CANB, MEL, PERTH); 100 m along Rest Point Rd from South Western Hwy, near Walpole, 5 Nov.1986, *T.D. Macfarlane 1734* (MEL, PERTH); 4 km NNE of Mt Pingerup, 8 Sept.1995, *R.J. Cranfield 10375* (PERTH).

Figure 5. *Bossiaea webbii* – a, flowering twig, × 1; b, flower bud showing the two basal outer bracts and the large inner bract (left) overtopping the two bracteoles (right), × 4; c, calyx opened out (upper lobes on right), × 4; d, standard, × 4; e, wing petal, ×4; f, keel petal, × 4; g, fruiting twig, × 1; h, enlarged apex of leaf showing the emarginate apex and the denticulate margin; i, seed, hilar view, × 10; j, seed, lateral view, × 10. a–f from *Ross 3004*; g–j from *Ross 3927*.

Conservation status: Relatively widespread and not under threat at present.

Notes: The distinctive semi-orbicular to semi-reniform leaves with minutely denticulate margins and an emarginate apex where the midrib is not produced into a distinct pungent point distinguish *B. webbii* from *B. aquifolium*. The branchlets in *B. webbii* are invariably glabrous as in typical *B. aquifolium* subsp. *aquifolium*, but the angular pungent-pointed leaves differentiate the latter. Leaf shape in *B. aquifolium* subsp. *laidlawiana* sometimes resembles that of *B. webbii* quite closely but the young branchlets of the former are always densely pubescent.

Bossiaea webbii is usually a smaller more slender plant than *B. aquifolium* and has a slightly different distribution, not occurring much further west than 30 km NNW of Walpole or north of Mt Frankland, whereas *B. aquifolium* does not occur much further south or east than just south-west of Lake Muir.

The orange rust fungus *Aecidium eburneum* McAlpine sometimes occurs on the green pods, as is the case in *B. aquifolium* subsp. *laidlawiana*.

2. *Bossiaea aquifolium* Benth., *Fl. Austral.* 2: 157 (1864). *Type*: 'W Australia, *Drummond* 2nd coll. n. 130'; syn.: BM, K (2 sheets), LD, MEL *105163*, *105164*, *105165*, NSW, PERTH; Darling Distr., 'Harvey river, [*W.*] *Clarke* [s.n.]'; syn.: K.

Slender shrub or small tree to 8 m high; branchlets terete, slender, glabrous or sparingly to densely clothed with appressed antrorse or curled hairs, the latter sometimes with longer spreading hairs up to 1 mm long interspersed, sometimes fairly conspicuously lenticellate. Leaves opposite, unifoliolate; lamina depressed ovate or broadly ovate to semi-orbicular, the midrib terminating in a pungent point, distinctly angular with each angle terminating in a pungent point and the margins distinctly sinuate between the pungent points or indistinctly angular and the margins dentate, (0.5–) 0.8–2.2 cm long, (0.5–) 0.8–2 (–2.6) cm wide, wider than long, slightly cordate basally, glabrous throughout or with scattered hairs, with venation simple craspedodromous; petiole 0.9–2.2 mm long, glabrous to densely pubescent. Stipules broadly triangular, 0.7–1.4 mm long, 0.5–0.9 mm wide, shorter than the petiole, persistent, glabrous to densely pubescent. Flowers solitary or in pairs, with basal bracts attached 0.1–0.5 mm above the base of the pedicel, with the pedicel glabrous or pubescent below the bracts, glabrous above; with the 2 outer basal bracts rigid, coriaceous, longitudinally striate, pubescent basally and with marginal cilia or sometimes sparingly pubescent throughout, persistent, dissimilar, together almost cupular, with the outer broadly ovate, 1.4–2.3 mm long, 1.5–2.4 mm wide, the inner encircling the pedicel basally, broadly ovate, 1.5–2.4 mm long, 2.3–3.4 mm wide; the innermost and largest bract elliptic, 6–10 mm long, rigid, coriaceous, longitudinally striate, with margins conspicuously ciliate, rarely villous throughout, internally woolly-pubescent apically, cucullate apically, enveloping the two inner bracteoles, rapidly caducous; bracteoles similar to the inner elliptic bract but smaller, 5.5–8.0 mm long, rapidly caducous. Calyx glabrous externally throughout except for marginal cilia on the lobes or with occasional scattered hairs: 2 upper lobes 1–2 mm long excluding the tube 2.3–4.2 mm long, with lobes rounded-truncate apically, with 3 lower lobes 0.8–1.5 mm long, 1.3–1.7 mm wide, sub-acute to obtuse apically, shorter than the tube. Standard more or less orbicular, 11.8–18.0 mm long including a basal claw 2.0–3.2 mm long, 10.8–18.5 mm wide, longer than the keel, emarginate apically, yellow or orange-yellow internally with a dark red, red or reddish-brown continuous basal flare around a greenish-yellow throat or the flare discontinuous and consisting of a patch on either side

Figure 6. Distribution of a, *Bossiaea webbii*; b, *B. aquifolium*; c, *B. dentata*; d, *B. pulchella*; e, *B. eriocarpa*; f, *B. ornata*.

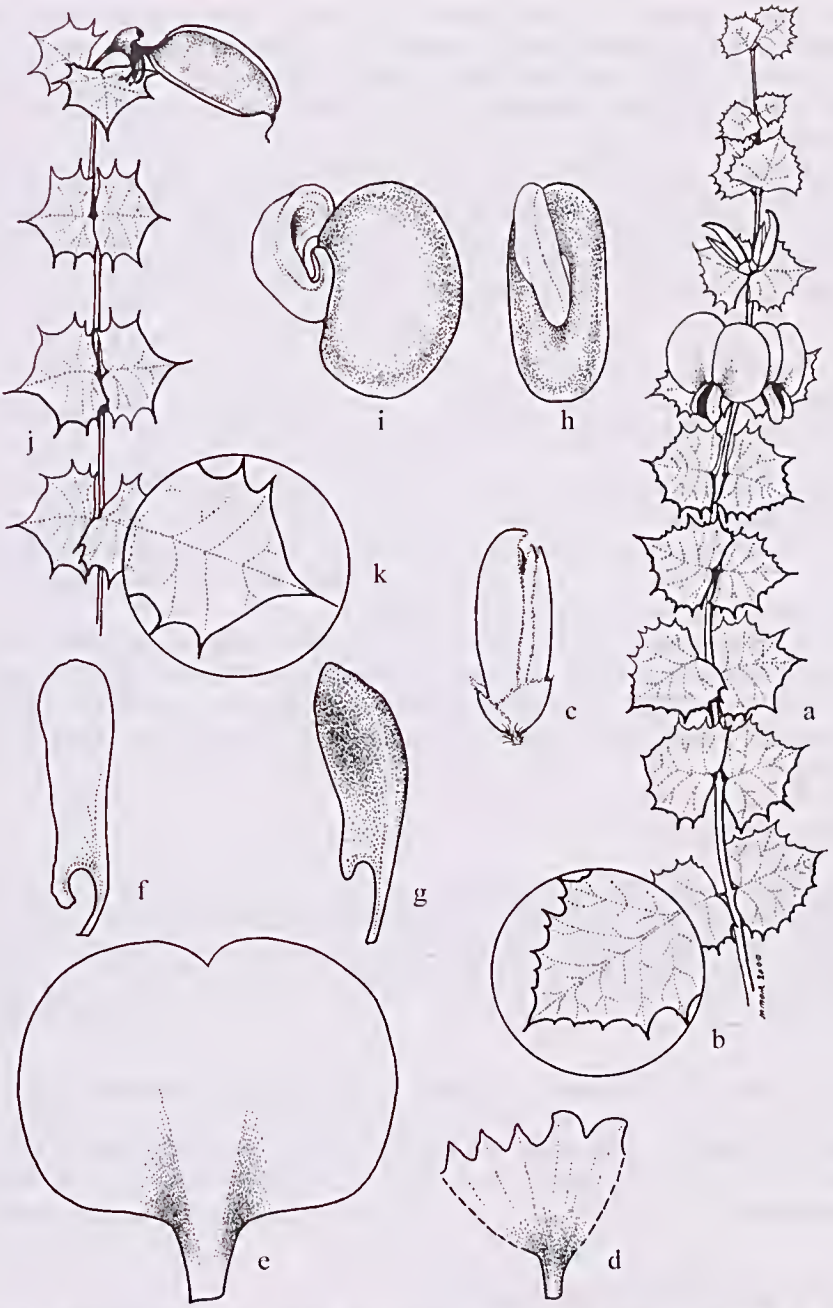

Figure 7. *Bossiaea aquifolium* subsp. *laidlawiana* – a, flowering twig, × 1; b, enlarged apex of leaf showing the midrib terminating in a pungent point and the margin with numerous teeth; c, flower bud showing the two basal outer braets and the large inner braet (left) overtopping the two braeteoles (right), × 4; d, ealyx, opened out (upper lobes on right), × 4; e, standard, × 4; f, wing petal, × 4; g, keel petal, × 4; h, seed, hilar view, × 10; i, seed, lateral view, × 10. *B. aquifolium* subsp. *aquifolium* – j, fruiting twig, × 1; k, enlarged apex of leaf showing the midrib terminating in a pungent point and the sinuate margin between the apical and lateral pungent points. a–g from *Corrick 9233*; h and i from *Ross 3953*; j and k from *Corrick 9417*.

of the throat, externally red basally passing to purplish-brown and then orange-yellow or yellow apart from red striations on either side of the midline; wings 9.7–13.7 mm long including a claw 2.3–3.3 mm long, auricled, 2.4–4.2 mm wide, usually longer than the keel, externally pinkish-red basally to red or reddish-brown throughout or basally only and then orange or yellow apically; keel 10–13 mm long including a claw 2.5–3.2 mm long, auricled, 3.2–4.8 mm wide, externally deep red or reddish-brown, glabrous apically. Stamen-filaments 7.4–11.0 mm long. Ovary 3.5–5.5 mm long, on a stipe 2.6–3.7 mm long, 2–4-ovulate, glabrous. Pods on a stipe exceeding the calyx, ovate-oblong to oblong-elliptic, 1.1–2.4 cm long, 0.7–1.1 cm wide, with valves thickened along the upper suture, conspicuously transversely venose, glabrous. Seeds ellipsoid, 3.2–3.5 mm long, 2.1–2.5 mm wide, reddish- to chocolate-brown (Fig. 7).

Distribution: Occurs in the Darling Botanical District of the Southwestern Botanical Province from the vicinity of Mundaring east of Perth south-westwards to near Margaret River and south-eastwards to near Lake Muir (Fig. 6).

Notes: Bossiaea aquifolium plays a very important role in the ecology of the *Eucalyptus marginata*, *E. diversicolor* and *Corymbia calophylla* forests where it is often a conspicuous component of the understorey. It is one of the species referred to as a 'fire weed'. If seed is present in the soil, the passage of a hot fire stimulates the germination of abundant seedlings (Ross, 1994a).

Two subspecies are recognised. Reliance on vegetative characters to differentiate the subspecies imposes limitations and some specimens are difficult to place. Because of the variation in leaf shape on some individual specimens, it may assist when keying out specimens to select leaves that exhibit the mid-point in the range of variation rather than the extremes.

Key to subspecies

Leaves angular, each angle terminating in a pungent point, the margin with (3–) 5–11 pungent points and usually distinctly sinuate between the points (especially between the apical and the adjacent lateral points); branchlets glabrous or sparingly to densely pubescent (often associated with *Eucalyptus marginata* and/or *Corymbia calophylla*)..... **2a.** subsp. ***aquifolium***

Leaves angular, only the apex terminating in a pungent point but the margin with numerous (usually 11–25) teeth and usually not deeply sinuate between the teeth; branchlets sparingly to densely pubescent (usually associated with *Eucalyptus diversicolor*, but sometimes with *E. marginata* or *Corymbia calophylla* or in stands of all three species)..... **2b.** subsp. ***laidlawiana***

2a. ***Bossiaea aquifolium*** subsp. ***aquifolium***

Young branchlets glabrous to densely pubescent; leaves distinctly angular, with (3–) 5–11 pungent points and the margin usually distinctly sinuate between the points, especially between the apical and adjacent lateral points; standard yellow or orange-yellow internally with a continuous dark red or red-brown flare around a basal yellow throat or the flare discontinuous and consisting of a dark red or red-brown patch on either side of the greenish-yellow throat; wings externally red or reddish-brown throughout or yellow or orange-yellow apically.

Distribution and habitat: Occurs from the vicinity of Mundaring in the Darling Range east of Perth south-westwards to the vicinity of Margaret River and south-eastwards to Collie and Nannup. Favours lateritic soils and clay loam. A common understorey species in *Eucalyptus marginata* and *Corymbia calophylla* forest. Flowers Sept.–Nov.

Representative specimens (68 examined): Coalfields Rd., 2 km W of Allanson, 12 Sept.1979, *J. Koch s.n.* (PERTH); near Newlands, ca 10 km S of Donnybrook, 4 Oct.1982, *M.G. Corrick 8342* (MEL); Mt Dale Rd., SE of Carinyah, 6 Nov.1983, *M.G. Corrick 9028* (AD, CANB, HO, MEL, NSW, PERTH); Darling Range, Mundaring Weir Rd., 5 Oct.1984, *M.G. Corrick 9199* & *J.H. Ross* (MEL, PERTH); 12 km S of Nannup on Vasse Hwy, 10 Oct.1984, *M.G. Corrick 9231* (MEL, PERTH); Glen Mervyn Dam, 22 Oct.1985, *M.G. Corrick 9729* (MEL, PERTH).

Conservation status: Relatively widespread and not under threat at present.

Notes: Typical subsp. *aquifolium* with essentially glabrous young stems and leaves occurs in the Darling Range east of Perth and southwards to the Harvey River. From the vicinity of Tallanella southwards to Balingup and south-westwards to Yallingup and north of Margaret River specimens occur which resemble typical subsp. *aquifolium* in every respect except the young stems are sparingly to densely clothed with hairs. These specimens are included in subsp. *aquifolium*.

A.N. Rodd 4798 & *G. Fensom* (PERTH) from 10.6 km E of Kelmscott on the Brookton Highway shows an unusual range of variation in leaf shape. Some leaves have the typical angular shape with each angle terminating in a pungent point, others are not angled apart from the apical point, and occasional leaves are almost hemispherical or reniform and lack even the apical point. The latter leaves are reminiscent of those found in *B. webbii* but lack the denticulate margin of that species.

The vernacular name for the species 'water-bush' is very apt. During rain, water collects in the axils of the opposite leaves and, when the branches are brushed against in passing, the reward is a shower of water.

Typification: The description of *B. aquifolium* was based on *J. Drummond* 2nd coll. no. *130* and *W. Clarke s.n.* There is in MEL a specimen of *Drummond 75* but, as *Drummond 75* was not cited explicitly in the protologue, the specimen is not regarded as a syntype of *B. aquifolium*. There are two sheets of unnumbered *Drummond* material in K and three sheets in MEL, one of which (MEL *105162*) is a twig removed from one of the K sheets and donated to MEL in 1921. An element of uncertainty surrounds these unnumbered *Drummond* sheets as they could be duplicates of *Drummond 75* just as easily as duplicates of *Drummond 130*, or perhaps duplicates of neither but a different collection to which Drummond did not assign a number. In view of this, they are not regarded here as syntypes even although some specimens on these unnumbered Drummond sheets are scarcely distinguishable from the material of *Drummond 130*. This inability to determine whether or not two Drummond specimens of a particular taxon are duplicates of the same collection is met with frequently.

James Drummond Snr made an exceedingly valuable contribution to the advancement of knowledge of the Western Australian flora. Given the extremely difficult circumstances under which he collected (Erickson, 1969), it is uncharitable to be critical but it is unfortunate that the numbering system Drummond employed for his collections was not more precise and it is regrettable that precise localities were never provided. His numbering system caused confusion almost from the time his specimens started to reach Europe (Bentham, 1863a). Bentham, in a letter to Mueller dated 17 November 1867, wrote in response to a question from Mueller: 'In one of your letters you speak of several of Drummond's nos. not being quoted by me, the reason is that

these number[s] are very irregularly preserved in the Hookerian herbarium which has the most complete set. The first collection was distributed in the first instance as sent over here without numbers, of this I see numerous specimens from the Hookerian, my own, Lindley's and other herbaria, corresponding specimens were afterwards sent with numbers which were not regularly entered in the herbaria which had them without numbers — then came successively the 2^{d} 3^{d} 4th 5th and 6th collections and various supplements all separately numbered and often in Sir William's set not numbered so that there is always the greatest uncertainty about the numbering and I once thought of not giving the numbers at all for fear of leading into error—sometimes also the numbers badly written have been misread and erroneously copied.' (Bentham, 1867). Drummond could have learnt much about labelling specimens from his contemporary Ludwig Preiss.

2b. *Bossiaea aquifolium* subsp. ***laidlawiana*** (Tovey & P.Morris) J.H.Ross, *Muelleria* 8: 206 (1994). *Bossiaea laidlawiana* Tovey & P. Morris, *Proc. Roy. Soc. Victoria new ser.* 34: 207 (1922). *Type*: 'Pemberton and Manjimup, Warren district, West Australia, Max Koch, No. 2244 Oct., Dec.1918; Western Australia, (in National Herbarium, Melbourne, without collector's name or precise locality.)': Pemberton (Big Brook), *M. Koch 2244*, Oct., Dec. 1918; lecto.: MEL *651289*; isolecto.: AD, MEL *651290*, *651293*.

Young branchlets sparingly to densely pubescent; leaves angular, only the apex terminating in a pungent point but the margin with numerous (11–25) teeth or points and usually not deeply sinuate; standard yellow internally with a discontinuous basal red flare around a greenish-yellow throat, the flare represented by a red patch on either side of the yellow throat and often with a red spot in the centre (the centrefold at the base of the standard) of the throat; wings externally red basally and yellow apically.

Distribution and habitat: Occurs from the vicinity of Nannup south and south-eastwards to just south-west of Lake Muir. Favours clay-loam soils which sometimes contain gravel. Most commonly encountered as an understorey to *Eucalyptus diversicolor* but sometimes found with *E. marginata* and *E. diversicolor*, with *E. marginata* and *Corymbia calophylla*, or in stands of all three species. Flowers Sept.–Nov.

Representative specimens (70 examined): Pemberton, Oct.1963, *W. Rogerson 83* (PERTH); Beedelup Falls, Beedelup National Park, 9 Sept.1965, *A.C. Beauglehole 12637* (MEL); Davidson's Rd. (W of Manjimup) near corner of Coronation Rd., 10 Oct.1984, *M.G. Corrick 9239* (MEL, PERTH); 12.7 km NE of Pemberton on Vasse Hwy, 14 Oct.1985, *J.H. Ross 2997* (MEL, PERTH); 4 km N of Donnelly River Mill (Wheatley), 13 Oct.1992, *T.D. Macfarlane 2068(2)* (MEL, PERTH); 7 km SSW of Lake Muir, 7 Sept.1995, *R.J. Cranfield 10362* (MEL, PERTH).

Conservation status: Relatively widespread and not under threat at present.

Notes: Several specimens from an area south and south-east of Nannup, for example *Corrick 9233*, *9242*, *10554* (MEL), are difficult to place in either subspecies with certainty. These have been referred with some doubt to subsp. *laidlawiana*.

Occasional flowers on a few specimens, for example, *Macfarlane 2068(2)* from 4 km N of Donnelly River Mill (MEL, PERTH), *Corrick 9242* from 7 km N of Donnelly River Mill (MEL), *Ross 2995* from Pemberton (MEL) and *Ross 2988* from Davidson Rd., 14.9 km E of the Vasse Hwy (MEL, PERTH), possess an extra pair of basal bracts. Flowers bearing the extra pair of basal bracts occur sporadically among flowers with the usual two basal bracts.

Ashby 2675 (PERTH) from Pemberton has sub-reniform leaves and shows a close superficial resemblance to *B. webbii*. However, the young stems in this specimen are densely pubescent unlike those of *B. webbii*.

Fairall 641 (PERTH) collected in October 1962 from the Valley of the Giants, east of Nornalup, represents a disjunct eastern record of the species. This appears to be an unnatural occurrence and it is possibly the result of seed being spread by machinery during road works.

The orange rust fungus *Aecidium eburneum* McAlpine sometimes occurs on the green pods. To date this fungus has not been recorded on pods of subsp. *aquifolium*.

3. *Bossiaea dentata* (R.Br.) Benth., *Fl. Austral.* 2: 156 (1864). *Scottia dentata* R.Br. in W.T. Aiton, *Hortus Kew.* edn 2,4: 269 (1812). *Type*: 'Nat. of the South West coast of New Holland. Robert Brown, Esq.': South Coast, Bay 1 [Lucky Bay, E of Esperance], Bay 2 [Goose Island Bay], January 1802, *R. Brown*; lecto.: BM (here selected); isolecto.: K, MEL *2172899*, PERTH.

Scottia angustifolia Lindl., *Edwards's Bot. Reg.* 15: t.1266 (1829). *Bossiaea dentata* var. *angustifolia* (Lindl.) Benth., *Fl. Austral.* 2:157 (1864). *Type*: 'Mr Mackay of the Clapton Nursery, by whom it was raised from New Holland seeds....Our drawing was made...in January of the present year': Specimen taken from a plant cultivated by Mr Mackay of Clapton Nursery, 1829; lecto.: CGE (here selected).

Scottia laevis Lindl., *Edwards's Bot. Reg.* 19: t.1652 (1834). *Type*: 'Mr Knight raised it from seeds gathered on the south coast of New Holland by Baxter': Specimen taken from a plant cultivated by Mr Knight; lecto.: CGE (here selected).

Bossiaea dentata var. *latifolia* Benth., *Fl. Austral.* 2: 156 (1864). *Type*: 'Drummond, n.88, and other collections': *J. Drummond 88*; lecto.: K sheet in Herbarium Benthamianum (here selected); isolecto.: BM, K (3 sheets), MEL *651108*, NSW.

Bossiaea dentata var. *hastata* Benth., *Fl. Austral.* 2: 156 (1864). *Type*: 'Preiss n. 1034, and other collections': *Preiss 1034*, 'In districtu Plantagenet', Oct. 1840; lecto.: LD (here selected); isolecto.: MEL *651109*, NY.

Erect shrub to 3 m high, stems often arching upwards and outwards, or low and spreading, sometimes prostrate and wind-pruned in exposed coastal situations, young branchlets terete or slightly flattened, glabrous or with scattered appressed antrorse hairs, sometimes extremities quite densely pubescent, usually tuberculate; young growth coppery. Leaves opposite, unifoliolate; lamina broadly ovate-cordate or triangular to hastate-lanceolate or almost linear, 0.8–3.0 cm long, 0.3–2.1 cm wide, glabrous above and below or sometimes lower surface and especially the midrib sparingly pubescent, with margin slightly thickened, irregularly denticulate, sometimes revolute and sometimes obscuring much of the lower surface of the lamina, acute or obtuse apically, with venation simple craspedodromous; petiole 0.7–1.8 mm long; glabrous or sparingly pubescent. Stipules ovate or narrow-ovate, 1.0–1.7 mm long, 0.6–1.0 mm wide, shorter than the petiole, glabrous apart from marginal cilia. Flowers solitary, pendulous, with basal bracts attached 1.0–2.5 mm above the base of the pedicel, with the pedicel densely appressed pubescent below the bracts, glabrous above; the outer basal bracts usually 2 (–5), rigid, coriaceous, longitudinally striate, persistent, dissimilar in size and shape, together almost cupular, with the outer bract broadly ovate, 1.8–2.0 mm long, 1.8–2.2 mm wide, pubescent basally and with marginal cilia, the inner bract encircling the pedicel and the opposing lateral margins overlapping each other basally, 2–2.5 mm long, 4.5–5 mm wide, oblique or truncate apically, often more conspicuously longitudinally striate than the smaller outer bract, margins ciliate; innermost and largest elliptic bract 10–12 mm long, rigid, coriaceous, longitudinally striate, with margins

conspicuously ciliate especially apically, enclosing the two inner bracteoles, cucullate apically, rapidly caducous; bracteoles similar to the inner elliptic bract but smaller, 8–10 mm long, caducous. Calyx glabrous externally except for hairs on the margins of the lobes, green and often suffused with red especially apically, with the lobes more or less of equal length but the upper 2 broader, shorter than the tube, rounded or obtuse to subacute apically; 2 upper lobes 1.8–2.5 mm long excluding the tube 6.2–8.8 mm long, with 3 lower lobes 1.6–2.5 mm long, obtuse to subacute. Standard more or less orbicular, 16.2–24.1 mm long with a claw 4 mm long, 13.2–16.5 mm wide, externally green, greenish-yellow, yellow, pale salmon-pink to dull red or deep burgundy, emarginate, margin sometimes ciliate apically, densely woolly-pubescent apically, much shorter than the wing and keel petals; wings 28.2–37.5 mm long including a claw 8.2–9.0 mm long, 4.1–5.0 mm wide, colour usually similar to standard, ciliate on the lower margin towards the apex and densely woolly pubescent apically; keel 27.8–36.2 mm long including a claw 7.8–8.3 mm long, 5–6 mm wide, colour usually similar to standard, densely woolly pubescent apically. Stamen-filaments 25.0–38.2 mm long. Ovary 9.0–11.2 mm long, on a stipe 7.5–11.0 mm long, 4-ovulate, glabrous. Pods on a stipe up to 1 cm long that exceeds the calyx, oblong, 2.0–3.5 cm long, 0.9–1.4 cm wide, with valves coriaceous, with thickened margins, conspicuously transversely venose, glabrous. Seeds ellipsoid, 3.8–4.7 mm long, 2.7–3.0 mm wide, uniformly pale chestnut to reddish-brown (Figs. 8, 9b).

Distribution and habitat: Occurs in the extreme east of the Menzies Subdistrict of the Darling Botanical District and in the Eyre Botanical District of the Southwestern Botanical Province. Found from near Albany eastwards along or near the coast with a number of large discontinuities to Cape Arid and on some of the off-shore islands, especially in the Recherche Archipelago (Fig. 6). Recorded from peaty loam, loam, clay, granitic soils and deep coastal sands, sometimes among the dunes in low mallee, scrub or heath; often favours the seepage lines below large granite boulders. Flowers July–Nov.

Representative specimens (53 examined): King River, 26 Dec.1877, *F. Mueller s.n.* (MEL *664745*); Recherche Archipelago, Sandy Hook Island, 10 Nov.1950, *J.H. Willis s.n.* (MEL *2086954*); Cape Arid National Park, Dolphin Cove, 25 Sept.1985, *M.G. Corrick 9541* (MEL, PERTH); Mt. Manypeaks, 20 Oct.1985, *M.G. Corrick 9713* (MEL, PERTH); Cape Le Grande National Park, 2.7 km SW of turn-off to Lucky Bay, 13 Nov.1996, *B. Archer 477* (MEL, PERTH).

Conservation status: Widespread and not under threat at present.

Notes: There is considerable variation in leaf shape and size, sometimes on a single plant. Flower colour varies quite markedly too but this is usually due to age. The flowers are often green or greenish-yellow when young but with age pass to salmon-pink and then to dull red or deep burgundy. Flower size varies also. Flowers in the western part of the distributional range near Albany tend to be larger than those further east and large flowers are often found on plants with narrow leaves. None of the variants is sufficiently well circumscribed to warrant formal recognition.

The leaves of *J.M. Brown 108* (PERTH), 26 Aug.1984, from Two Peoples Bay Nature Reserve, have recurved margins and the lamina is almost linear and sometimes falcate.

A very distinctive species which is easily distinguished by its large pendulous flowers from each of the other species with opposite leaves in Western Australia. Apart from the obvious difference in leaf shape and flower size, *B. dentata* differs from *B. webbii* and *B. aquifolium* in that the standard petal is very much shorter than the wing

and keel petals, and the standard, wing and keel petals are woolly-pubescent apically. The usual presence of tubercules on the young branchlets further helps to distinguish *B. dentata*.

The large pendulous flowers, the reduced size of the standard petal relative to the wing and keel petals, and the elongated pink to burgundy wing and keel petals suggest that *B. dentata* is pollinated by birds. There appear to be no published records, but Western Spinebills and New Holland Honeyeaters have been observed feeding on flowers at Cape Le Grande National Park (B. Archer, pers comm.).

Typification: It is not clear whether R. Brown based his description of *Scottia dentata* on a plant raised at Kew Gardens from seed collected by Peter Good or himself in Western Australia, whether the description was based on his own specimens collected in Australia, or whether it was based on material in cultivation and on dried specimens. I have not located a specimen at BM from a plant cultivated at Kew which suggests that the description was based on his own material. There is in BM a composite sheet of material collected by Brown [5075] from Bay 1 [Lucky Bay] and Bay 2 [Goose Island Bay] in January 1802. This BM sheet bears three labels. Towards the top right hand corner is a white label in Brown's hand which reads 'Wrightia rigida/ Bay 1 South Coast/ Jany 10 1802/Legum cum sem', below this is a blue printed J.J. Bennett 'Iter Australiense, 1802-5' label to which the number 5075 has been assigned and superimposed on this blue label is a white one in Brown's hand which reads 'Platyloboides/ Bay I - II/ South Coast.' In the bottom left hand corner is a more recent white printed label which bears the locality data from Stearn's Introduction to Robert Brown's Prodromus. Unfortunately it is not possible to determine the locality from which each individual specimen on the sheet was collected. A similar composite sheet of Brown material is in K and in MEL. In addition, there are at K two sheets distributed by Bennett which are numbered 5075 and named 'Wrightia rigida'. Normally I would have selected as lectotype of *Scottia dentata* either the Brown specimen in BM from Lucky Bay or the specimen from Goose Island Bay. However, in this instance, as it is not possible to determine the locality from which the individual specimens on the composite sheet were gathered, I here select the composite sheet in BM as the lectotype. The sheets at K, MEL and PERTH are treated as isolectotypes.

Bentham based his var. *latifolia* on 'Drummond, n. 88, and other collections'. It is uncertain precisely which specimens were included in 'and other collections'. In view of this, the sheet of *Drummond 88* material in Bentham's own herbarium at K is here selected as the lectotype of var. *latifolia*. The three other sheets of *Drummond* 88 at K are regarded as isolectotypes.

Similarly, Bentham based his description of var. *hastata* on 'Preiss, n. 1034, and other collections'. There is no specimen of *Preiss 1034* in K or BM so presumably Bentham saw a specimen during his continental travels and it is not known which specimens were included in 'and other collections'. The specimen of *Preiss 1034* in LD is here selected as the lectotype of var. *hastata*.

4. *Bossiaea pulchella* Meisn. in J.G.C.Lehmann, *Pl. Preiss*. 1: 84 (1844). *Type*: 'In umbrosis limoso-calculosis sylvae inter Mahogany Creek et Halfwayhouse (Darling's-range) d. 13 Sept.1839, Herb. Preiss. No. 1032 (Drummond n. 250 et coll.1)'; *Preiss 1032*; syn.: LD, MEL *664785*, NY; *J. Drummond 250*; syn.: MEL *664783*.

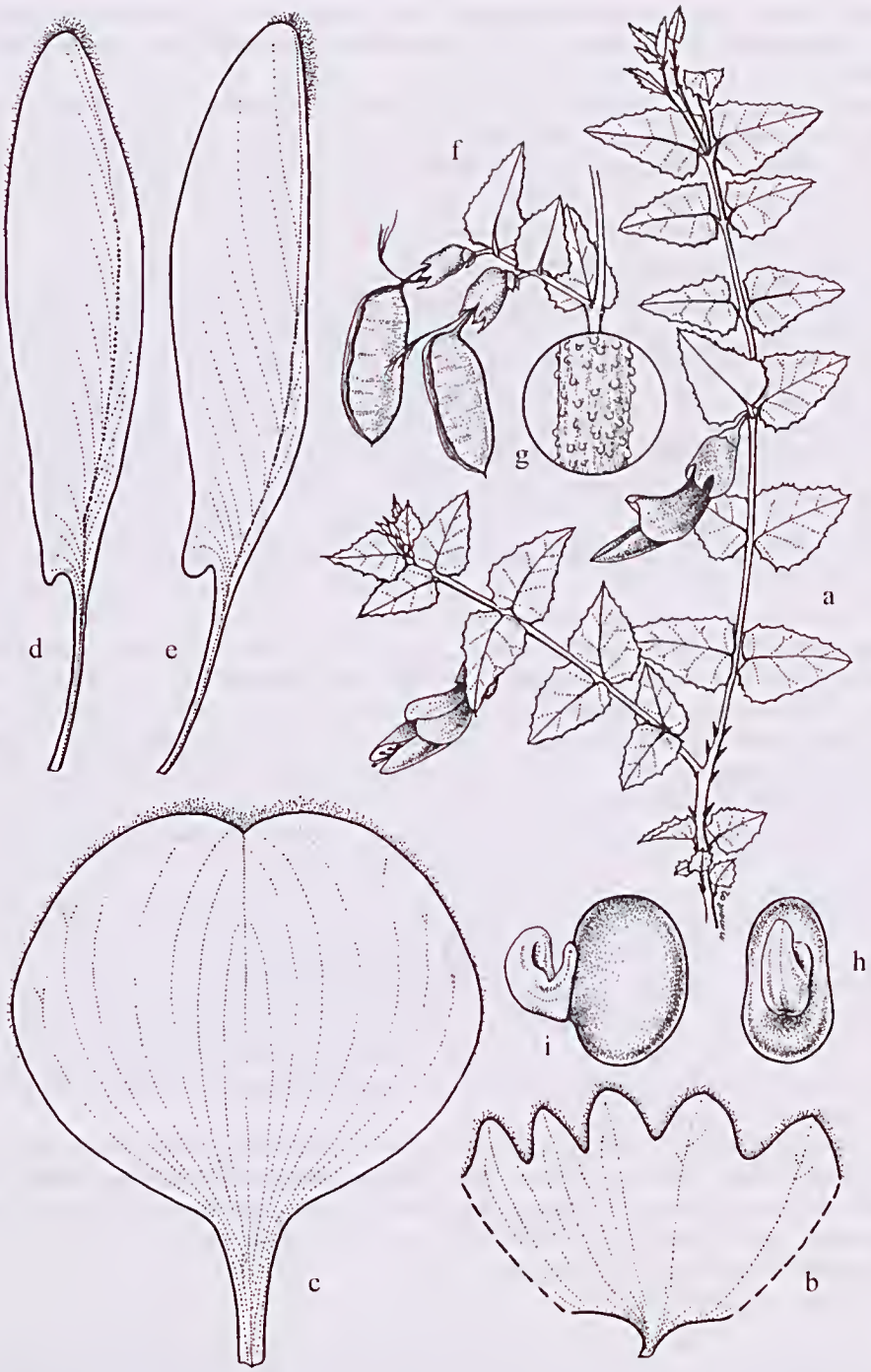

Figure 8. *Bossiaea dentata* — a, flowering twig, × 1; b, calyx opened out (upper lobes on right), × 4; c, standard, × 4; d, wing petal, × 4; e, keel petal, × 4; f, fruiting twig, × 1; g, enlarged young stem showing the numerous conspicuous tubercules; h, seed, hilar view, × 6; i, seed, lateral view, × 6. a–e from *B. Archer 396*; f–i from *B. Archer 477*.

Figure 9. Photographs of a, *Bossiaea spinosa*; b, *B. dentata*; c, *B. arcuata*; d, *B. barbarae*; e, *B. concinna*. Photographs by Barbara Areher.

Slender shrub to 1.5 m high, branchlets terete or slightly flattened but not angled, densely clothed with appressed or spreading hairs. Leaves alternate, unifoliolate; lamina ovate, 0.3–1.0 (–1.2) cm long, 0.2–0.8 (–0.9) cm wide, cordate basally, with margin minutely and irregularly crenulate, not recurved, glabrous or almost so, light green, with venation obscure, more or less simple craspedodromous but with 2–4 main basal veins arising from near the point of insertion of the midrib and tending to campylodromous; petiole 0.3–1.5 mm long, glabrous or sparingly pubescent. Stipules triangular, 0.3–0.6 mm long, shorter than the petiole, scarious, appressed, persisting, with margins densely ciliate. Flowers solitary, with basal bracts attached c. 0.5 mm above the base of the pedicel, with the pedicel densely pubescent below the bracts, glabrous above; the outer bracts usually 2 (–5) rigid, coriaceous, longitudinally striate, glabrous apart from marginal cilia or also with scattered hairs along the midline, persistent, dissimilar, together almost cupular, with the outer broadly ovate, 2–2.2 mm long, 1.5–2.1 mm wide, concave, the inner bract encircling the pedicel and the opposing lateral margins overlapping each other basally, broadly ovate, oblique, 1.5–2.2 mm long, 2.8–3.2 mm wide; innermost and largest bract elliptic, 5.1–5.4 mm long, enveloping the inner bracteoles in bud, rigid, coriaceous, longitudinally striate, with margins conspicuously ciliate and internally woolly-pubescent apically, cucullate apically, rapidly caducous; bracteoles similar to the inner elliptic bract but smaller, 4.7–7.0 mm long, 2.0–2.8 mm wide, caducous. Calyx glabrous externally apart from hairs on the margins of the lobes; the lobes more or less of equal length but the 2 upper lobes broader than the lower 3 lobes, truncate, 1.0–1.5 mm long excluding the tube 3–4 mm long, with 3 lower lobes 0.7–1.2 mm long, acute or obtuse, shorter than the tube. Standard 10.8–14.0 mm long including the claw 3.6–4.6 mm long, 10.2–11.2 mm wide, longer than the keel, orange-yellow internally with a purplish-brown basal flare around a red or yellowish throat, externally reddish-brown basally with a yellowish-brown margin; wings 8.7–10.3 mm long including the claw 2.6–3.4 mm long, sometimes longer than the keel, 1.6–2.7 mm wide, dark red; keel 8.0–9.7 mm long including the claw 2.8–3.6 mm long, 2.7–3.5 mm wide, dark red, glabrous apically. Stamen-filaments 6–11 mm long. Ovary 3.0–4.2 mm long, on a stipe 3.0–4.2 mm long, glabrous, 1- or 2-ovulate. Pods 1.0–1.4 cm long, 0.8–1.0 cm wide, scarcely longer than wide, on a stipe that exceeds the calyx, with valves thickened along the upper suture, conspicuously transversely venose, glabrous. Seeds 3.5–4.0 mm long, 2.5–2.7 mm wide, chestnut-brown (Fig. 11).

Distribution and habitat: Confined to the Drummond and Dale Subdistricts of the Darling Botanical District and the south-western portion of the Avon Botanical District of the Southwestern Botanical Province from the vicinity of Redhill and Chidlow in the north southwards to Busselton and inland to south of Narrogin (Fig. 6). Favours lateritic soils and often associated with *Eucalyptus marginata* or *Corymbia calophylla*. Flowers in Sept.–Oct.

Representative specimens (32 examined): Chidlow, Sept.1942, *C.A. Gardner s.n.* (PERTH *02722305*). Near Busselton, 14 Sept.1969, *A.R. Fairall 2561* (PERTH). Helena Valley, 21 Aug.1977, *J. Seabrook 147* (PERTH). Mt Cooke, 28 Sept.1985, *M.G. Corrick 9579* (CANB, MEL, NSW). Mahogany Creek, 24 Nov.1996, *J.H. Ross 3844* (MEL, PERTH). Shire Gravel Reserve 20020, S. of Narrogin, 15 Oct.1999, *G. Warren & P. Rose 448* (PERTH).

Conservation status: CALM Conservation Code for Western Australian Flora: Priority Four.

Notes: The heart-shaped leaves readily distinguish *B. pulchella* from the other non-spinescent species with alternate leaves.

The anthers of *B. pulchella* are unique in that the adaxial inner faces of the thecae are clothed with long dense hairs, especially apically. *Bossiaea pulchella* is also unusual in that the ovaries possess only 1 or 2 ovules, and the pods are scarcely longer than broad.

5. *Bossiaea eriocarpa* Benth. in S.F.L.Endlicher *et al.*, *Enum. Pl. Huegel* 36 (1837); Benth., *Fl. Austral.* 2: 159 (1864). *Bossiaea eriocarpa* var. *normalis* Benth., *Fl. Austral.* 2: 159 (1864). *Type*: 'King Georges Sound, (Hügel)'; *Huegel*, lecto.: W (here selected); isolecto.: K.

Bossiaea ovalifolia Endl. in S.F.L.Endlicher *et al.*, *Nov. Stirp. Dec.* 3: 21 (1839). *Bossiaea endlicheri* var. *ovalifolia* (Endl.) Meisn. in J.G.C.Lehmann, *Pl. Preiss.* 1: 83 (1844). *Bossiaea endlicheri* Meisn. in J.G.C.Lehmann, *Pl. Preiss.* 1: 83 (1844), nom. illegit. *Type*: 'Colitur in horto Hügeliano'; lecto.: W (here selected).

Bossiaea gilbertii Turcz., *Bull. Soc. Imp. Naturalistes Moscou* 26: 286 (1853). *Type*: 'Gilbert 313. cum B. erioearpa Bth. mixta'; *Gilbert 313*; lecto.: KW (here selected).

Bossiaea nervosa Meisn., *Bot. Zeit.* 10: 31 (1855). *Type*: 'Drumm. Coll. VI. n. 29'; between Moore and Murchison Rivers, *J. Drummond 6th coll., n. 29*; lecto.: NY (here selected); isolecto.: K, MEL *105233*.

Bossiaea eriocarpa var. *eriocalyx* Benth., *Fl. Austral.* 2: 159 (1864). *Type*: Swan River, *J. Drummond 255*; lecto.: K (here selected); isolecto.: MEL *651112*.

Bossiaea eriocarpa var. *planifolia* Domin, *Vestn. Kral. Ceske Spolecn. Nauk., Tr. Mat.-Prir.* 1921-2, 2: 39 (1923). *Type*: 'Mallet cum praecedente' [A.A. Dorrien-Smith]; Western Australia, *A. Dorrien Smith*; lecto.: K (here selected).

Shrub to 0.6 (–1) m high; young branchlets terete or slightly flattened, usually densely pubescent or villous with hairs to 2 mm long but sometimes glabrous or almost so, sometimes with a thin outer white waxy layer and appearing as though whitewashed. Leaves alternate, unifoliolate; lamina narrow-oblong or linear, rarely elliptic, 0.5–2.5 (–3.5) cm long, 1.5–6 mm wide, base slightly cordate, apex obtuse or retuse and usually mucronate, the mucro often recurved or slightly uncinate, upper surface arched up on either side of a depressed midrib, shiny, glabrous throughout and often scabrous or sometimes with scattered hairs throughout or the hairs confined to the midrib, lower surface paler than the upper, midrib prominent, glabrous throughout, with hairs confined to the midrib or densely pubescent throughout, with margins recurved, sometimes obscuring much of the lower surface of the lamina, with venation simple craspedodromous, the lateral veins inserted almost at right angles to the midrib and terminating at the margin; petiole 0.8–2 mm long, often with a small apical dorsal spur, glabrous to densely villous. Stipules subulate, setaceous or narrowly ovate, sometimes asymmetric basally, 0.6–4 mm long, longer than the petiole when young, scarious, longitudinally striate, persistent, glabrous or pubescent, spreading, sometimes arcuate. Flowers solitary or sometimes paired or in threes or pseudoracemose, with pedicels 0.3–2 cm long, glabrous to densely villous, the hairs often spreading and up to 2 mm long, with a series of scarious imbricate basal bracts that increase in size up the length of the pedicel; bracts very variable in size and number, with outer basal bract 1–2 mm long, 0.8–1.5 mm wide, the innermost bract usually 2–7 mm long, 2–4.5 mm wide, glabrous except for marginal cilia or pubescent, occasionally the innermost pair of bracts greatly enlarged, narrowly elliptic or ovate, up to 12 mm long and 4.5 mm wide and enveloping the young flower buds and bracteoles, longitudinally striate, glabrous or pubescent, rapidly caducous or sometimes persistent; bracteoles very variable, usually inserted a short distance below the calyx and often overlapping the base of the calyx, narrowly ovate or elliptic, 0.15–11.5 mm long, 0.8–3.2 mm wide, brown, scarious or not,

conspicuously or inconspicuously longitudinally striate, glabrous throughout except for marginal cilia or sparingly to densely pubescent throughout, rapidly caducous or persistent. Calyx glabrous throughout externally to sparingly pubescent or densely villous, all lobes of similar length but the two upper lobes much broader than the 3 lower lobes; 2 upper lobes often suffused with red, 3–7 (–9.5) mm long excluding the tube 1.8–3.6 (–5) mm long, acute or acuminate, 3 lower lobes 3.5–8 (–10) mm long, acute or acuminate, about as long as the tube. Standard orbicular or depressed ovate, 9.2–14.5 (–20) mm long including a basal claw 3–6 mm long, 8.5–14 (–18) mm wide, longer than the keel, yellow internally (sometimes orange or pale pink) with a basal red flare around a yellow throat, occasionally yellow throughout, externally reddish-brown, glabrous; wings 9–13 (–14.3) mm long including a claw 1.7–3.3 mm long, auricled, 2.8–4.5 (–4.9) mm wide, externally red throughout or yellow apically; keel 8.8–11 (–13) mm long including a claw 3–4.5 mm long, auricled, 3–4.6 (–6) mm wide, externally red or purplish-red throughout or greenish-white basally, glabrous. Stamen-filaments 7.4–14 mm long. Ovary subsessile, 3.6–5.5 (–8) mm long, 5–10 (–12)-ovulate, densely villous. Pods shortly stipitate, the stipe not or scarcely exceeding the calyx-tube, oblong, 1.2–3 cm long, 0.5–0.8 cm wide, oblique basally, with a small mucro apically, densely villous, the hairs up to 2.5mm long. Seeds ellipsoid, 2.4–2.7 mm long, 1.2–1.6 mm wide, chestnut-brown (Fig. 12).

Distribution and habitat: Occurs in the Irwin, Darling, Avon and Eyre Botanical Districts of the Southwestern Botanical Province from the Zuytdorp National Park in the north southwards along the coastal plain and Darling Range to near Busselton in the south-west, east to Kokardine, Tammin and Katanning and southwards to Albany and the eastern Stirling Range (Fig. 6). Recorded on sand, gravelly clay soil, laterite, sand over laterite, limestone and damp swampy ground in a diversity of vegetation communities including low heathland, shrubland, sandplain, mallee, *Banksia* woodland and eucalypt (mainly *Eucalyptus marginata*, *E. wandoo* Blakely, *E. diversicolor* and *Corymbia calophylla*) woodland or forest. Flowers Aug.–Nov.

Representative specimens (271 examined): Applecross, 1946, *W.H. Nicholls s.n.* (MEL *1528586*); Near Geraldton Rd, 48 km NNW of Regan's Ford, 31 Aug.1966, *R.V. Smith 66/162* (MEL); W. of Northampton, 9 Sept.1967, *A.M. Ashby 2306* (MEL, PERTH); Gosnells, 1 Aug.1978, *R.J. Cranfield 533* (MEL, PERTH); Tammin Reserve, 31 Sept.1982, *H. Demarz 9287* (PERTH); Near Neerabup National Park, 29 Aug.1984, *D.B. Foreman 357* (AD, CANB, MEL, PERTH); Great Northern Hwy, 44 km S of New Norcia, 23 Oct.1984, *M.G. Corrick 9302* (MEL, PERTH); Geographe Bay, hillside above Bunker Bay, W. of Dunsborough, 11 Oct.1984, *M.G. Corrick 9252* (MEL); Porongorup Range scenic drive, 18 Oct.1985, *M.G. Corrick 9693* (MEL); 3.2 km NNW of Wongan Hills, 31 Aug.1990, *B.H. Smith 1325* (BRI, CANB, HO, MEL, PERTH).

Conservation status: Widespread and not under threat.

Notes: As indicated by Bentham (1864) and Wheeler (1987), *B. eriocarpa* is an extremely variable species, especially in relation to floral characters. Bentham, although acknowledging the presence of many intermediates, recognised two varieties which he differentiated on the basis of flower size, pedicel length, degree and nature of the indumentum on the external calyx surface and the size of the bracteoles. Variety *normalis* was distinguished by having large flowers, glabrous or pubescent calyces and usually broad bracteoles, and var. *eriocalyx* by having smaller flowers, shorter pedicels, villous calyces and narrow bracteoles. Wheeler (*l.c.*) noted the occurrence of two variants in the Perth Region which were characterised by a slightly different

combination of the same characters used by Bentham, but did not accord them formal recognition.

Apart from differences in the pubescence of the calyx and the length of the pedicel, the greatest degree of variation occurs in the size and shape of the bracteoles and whether they are caducous or persistent, and in the number, size and shape of the basal bracts on the pedicel. The variation is complex and although certain differential tendencies occur, because of the presence of intermediates and the tendency for the different characters to be correlated inconsistently, I have been unable to correlate the variation in any meaningful way. Consequently, no infraspecific taxa are recognised formally here.

The two main variants encountered are characterised as follows:

Variant 1. Calyx pubescent or villous; pedicels short (up to 10 mm long), densely pubescent or villous; bracteoles small (2.5–5.0 mm long, 0.8–1.2 mm wide), persistent or caducous (sometimes both states on the same shoot); innermost basal bract 2–4 mm long, 0.8–2.5 mm wide; ovaries 5–8-ovulate. The majority of specimens (70% of those examined) are referable to this widespread variant which accords with Bentham's var. *eriocalyx*. It occurs from Kalbarri southwards to Albany. Representative specimens amongst those cited above are: *Ashby 2306*, *Corrick 9302*, *9693* and *B.H. Smith 1325*.

Variant 2. Calyx glabrous (occasionally glabrous and sparingly pubescent calyces occur on the same shoot); pedicels usually 8–20 mm long but sometimes shorter (3–8 mm long) pedicels are associated with glabrous calyces (*Foreman 357*), glabrous or sparingly pubescent; bracteoles large, (4.5–10 mm long, 1.3–2.5 mm wide), caducous; innermost basal bract 2–7 mm long, 2.0–3.5 mm wide; ovaries 8–12-ovulate. This variant, which accords largely with Bentham's var. *normalis* (the flowers on the type of *B. eriocarpa* have glabrous calyces), occurs most frequently on the coastal plain from the vicinity of Yanchep southwards to inland of Busselton. Representative specimens amongst those cited above are: *Nicholls s.n.* and *Cranfield 533*. Specimens with glabrous calyces often flower earlier than the other specimens but to a large extent flowering time is correlated with distribution regardless of indumentum, specimens in the north tending to flower earlier than those in the south.

Other specimens are encountered that cannot be accommodated satisfactorily in either of the two above variants and, furthermore, tend to blur the distinctions between them. In some specimens the innermost two basal bracts are greatly enlarged (up to 12 mm long and 4 mm wide) and approach in size or exceed the large bracteoles and envelope the bracteoles and sometimes the flower buds. Although sometimes correlated with glabrous calyces, for example *McHard s.n.*(MEL *653796*) from the Blackwood River, large bracts occur more commonly on specimens with pubescent calyces, for example *McHard s.n.* (MEL *563517*) from Blackwood, *Corrick 9252*, *R.V. Smith 66/162*, and *Ross 3622* (MEL) from near Cataby. These specimens tend to have a greater number of bracts than in either of the variants described above. When present, the large persistent bracts and bracteoles are very conspicuous. There is a tendency for specimens with large bracteoles to have a greater number of ovules per ovary than other specimens, even when the bracteoles are caducous.

Huggens s.n. (MEL *1588969*) from Regan's Ford and *Huggens s.n.* (MEL *1588968*) from NE of Jurien are atypical in having exceedingly large bracts and bracteoles. *Huggens* (MEL *1588968*) has exceptionally large flowers on densely pubescent pedicels up to 12 mm long and densely villous calyces (upper calyx lobes 8.5–9.5 mm long excluding the 3.5–4.5 mm long tube, the 3 lower lobes 8–10 mm long; standard to 20

mm long, 18 mm wide; wings to 14.3 mm long, 5 mm wide; keel to 13 mm long, 6 mm wide, stamen-filaments 14 mm long) and the leaves are much larger (to 3.5 cm long and 0.5 cm wide) than those usually found in the species.

Leaf size and shape varies quite markedly but the variation exhibited does not appear to correlate with any of the other differential tendencies. Specimens with elliptic leaves which Endlicher described as *B. ovalifolia* occur mostly north of Perth.

A small population N of Dandaragan on the Badgingara–Dandaragan road deserves mention. The plants differ from typical *B. eriocarpa* in being weak-stemmed procumbent shrubs up to 25 cm high with wiry brittle stems, elliptic leaves (they have the typical simple craspedodromous venation with the lateral veins inserted at almost at right angles to the midrib), and small flowers (the 3 lower calyx lobes do not exceed 3 mm in length which is shorter than those recorded in *B. eriocarpa*). Indumentum and flower colour match those of typical *B. eriocarpa*. This population occurs in a narrow strip of remnant roadside vegetation and is at risk of being smothered by weeds. *Chandler 244 & Keys* (CANB, MEL, PERTH), and *Ross 4074*, *4075* (MEL, PERTH) represent this entity. Although the plants are atypical of *B. eriocarpa*, they share so many of the attributes of this species, they are for the present included in this species. The status of this entity requires clarification.

B. eriocarpa is usually readily distinguished from *B. ornata* by leaf shape alone but some specimens of *B. eriocarpa* with large leaves are sometimes confused with atypical specimens of *B. ornata* which have narrow leaves. The two species are separated readily by differences in leaf venation: in *B. eriocarpa* the venation is simple craspedodromous, the secondary veins are inserted almost at right angles to the midrib and terminate at the margins, whereas in *B. ornata* the venation is semicraspedodromous to mixed craspedodromous or almost reticulodromous, the secondary veins branching and looping just before they reach the margin. A further differential tendency is that in *B. ornata* the apices of the keel petals are minutely fimbriate, a situation that occurs infrequently in *B. eriocarpa*.

Bossiaea eriocarpa appears to be less resistant to fire than *B. ornata* and regeneration is largely from seed. In *B. ornata*, on the other hand, it is usual to observe shoots regenerating from a lignotuber.

Bossiaea divaricata differs from *B. eriocarpa* in being a rigid divaricately-branched shrub with spine-tipped abbreviated lateral branches and in having a different leaf venation. It has a more eastern distribution.

Typification: Endlicher based his description of *B. ovalifolia* on a specimen cultivated in Huegel's garden. The specimen is housed in W and is here selected as the lectotype. The specimen consists of three small shoots, the longest of which is about 13 cm long. The central shoot is sterile but the other two are in flower. The calyces are densely pubescent and the specimen is referrable to Variant 1.

Bossiaea endlicheri Meisn. in J.G.C.Lehmann, *Pl. Preiss.* 1: 83 (1844), is illegitimate as Meisner cited *B. ovalifolia* Endl., an earlier name, in synonymy under one of the varieties (*ovalifolia*). As the name *B. endlicheri* is illegitimate, the names *α ovalifolia*, *β angustifolia* and *γ minor* are illegitimate as they are not attached to a validly published binomial. Specimens of *Preiss* 1008 from 'In solo limoso inter frutices sylvae prope villam el. Harris ad fluv. Cygnorum', cited by Meisner under var. *ovalifolia*, are housed in LD and NY.

Meisner's description of *B. endlicheri* var. *angustifolia* was based on 'James Drummond n. 255 et coll. 1' from Swan River. Specimens of both Drummond collections are housed in K and MEL (*651112*).

Meisner based his description of *B. endlicheri* var. *minor* on *Preiss 1000* from 'In region. interior. Australiae occidentalis et meridionali-occidentalis'. There is a specimen of *Preiss 1000* in LD: there does not appear to be a specimen of *Preiss 1000* in Meisner's own herbarium in NY.

Meisner based his description of *B. nervosa* on *J. Drummond, 6th coll., no. 29.* I here select the Drummond specimen in NY as the lectotype of *B. nervosa*. There is a specimen in LD labelled 'Drummond 3rd coll. No. 29'. This specimen is a good match of the lectotype of *B. nervosa* in NY but, as it is attributed to Drummond's 3rd collection rather than his 6th (possibly in error), it is not treated as type material.

Bentham, *Fl. Austral.* 2: 159 (1864), cited in synonymy under *B. eriocarpa* var. *eriocalyx* Benth. both *B. endlicheri* var. *angustifolia* and *B. gilbertii*. Bentham had access to 'James Drummond n. 255 et coll 1' upon which Meisner based his *B. endlicheri* var. *angustifolia*, but indicated that he had not seen *Gilbert 313*, the type of *B. gilbertii*. I here select *J. Drummond 255* at K as the lectotype of *B. eriocarpa* var. *eriocalyx*. An isolectotype is at MEL (*651112*).

6. *Bossiaea ornata* (Lindl.) Benth., *Fl. Austral.* 2: 158 (1864). *Lalage ornata* Lindl., *Edwards's Bot. Reg.* 20: t.1722 (1834); Meisn. in J.G.C.Lehmann, *Pl. Preiss.* 1: 85 (1844). *Type*: 'A native of the south-west coast of New Holland, where its seeds were collected by Mr. Baxter. Our drawing was made in Mr Knight's Nursery in April last.'; lecto.: Bot. Reg. 20: t.1722 (here selected).

Lalage hoveifolia (as *hoveaefolia*) Benth. in Lindley, *Edwards's Bot. Reg.* 25, appendix [to vols.1-23: Sketch Veg. Swan River] : xv (1839); Meisn. in J.G.C.Lehmann, *Pl. Preiss.* 1: 86 (1844). *Type*: Not cited. Western Australia, 1839, *J. Drummond*; lecto.: K (here selected); isolecto.: CGE.

Lalage acuminata Meisn. in J.G.C.Lehmann, *Pl. Preiss.* 1: 86 (1844). *Type*: 'In districtu Wellington, m. Dec. 1839. sterilis. Herb. Preiss. No. 1003'; lecto.: LD (here selected); isolecto.: MEL *105911*.

Lalage angustifolia Meisn. in J.G.C.Lehmann, *Pl. Preiss.* 1: 86 (1844). *Type*: 'Swan River, James Drummond n. 253'; lecto.: K (here selected); isolecto.:MEL *105912*.

Lalage stipularis Meisn. in J.G.C.Lehmann, *Pl. Preiss.* 1: 87 (1844). *Type*: 'In region. interior. Australiae occidentalis sterilis Herb. Preiss. No. 1006'; lecto.: LD (here selected).

Bossiaea lalagoides F. Muell., *Fragm.* 4: 12 (1863). *Type*: 'In praeruptis ad flumen Gardner's river. Maxw.'; lecto.: MEL *105232* (here selected); isolecto.:K.

Shrub usually to 1.2 m high but sometimes to 2 m, often with many stems arising from a woody rootstock, young branchlets terete or oval in section to slightly flattened, usually densely pubescent or villous but sometimes glabrous. Leaves alternate, unifoliolate; lamina extremely variable, ovate, broadly ovate, narrowly ovate or linear-oblong, (0.8–) 1.6–6.0 cm long, (0.2–) 0.5–3.0 (–3.8) cm wide, often cordate or rounded basally, acute or mucronate apically, the mucro often slightly uncinate or recurved, coriaceous, with margins entire, flat or sometimes almost revolute, upper surface densely appressed pubescent when young but soon becoming glabrous, scabrous, lower surface sparingly to densely appressed or spreading pubescent or glabrous, with venation semicraspedodromous or mixed craspedodromous to reticulodromous; petiole 1.5–4.0 mm long, densely pubescent, villous or glabrous. Stipules subulate to narrowly ovate, sometimes asymmetric basally, 2–6 mm long, 0.8–1.5 mm wide, longer than the petiole, scarious, longitudinally striate, persistent, pubescent or villous, often recurved. Flowers solitary or more usually 2 or 3 together, subtended by a series of up to 13 reddish-brown scarious imbricate basal bracts that increase in size up the length of the

Figure 10. Photographs of variation in flower colour of *Bossiaea preissii*, Condingup. Photographs by Barbara Archer.

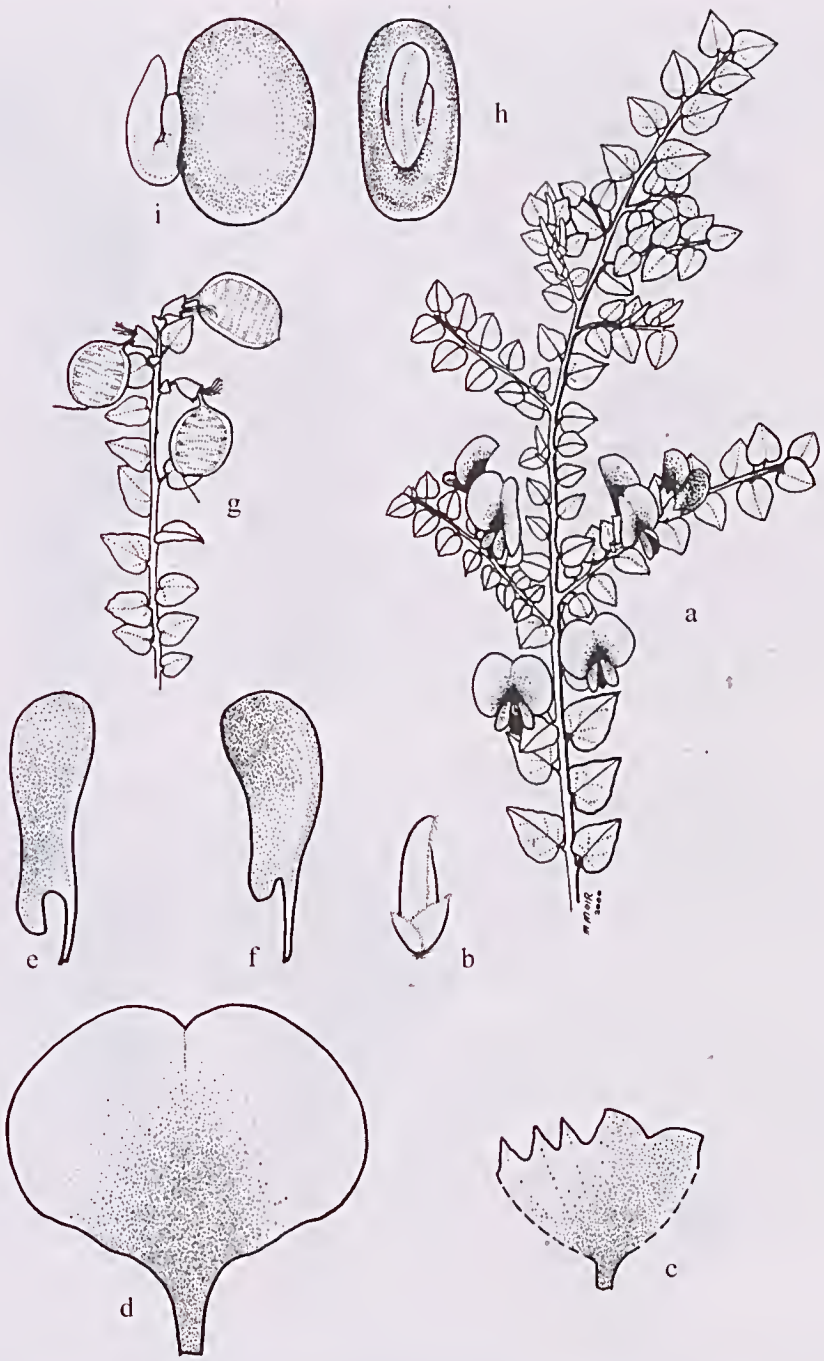

Figure 11. *Bossiaea pulchella* – a, flowering twig, × 1; b, young flower bud showing the two basal bracts and the large inner bract (left) overtopping the bracteoles (right), × 4; c, calyx opened out (upper lobes on right), ×4; d, standard, × 4; e, wing petal, × 4; f, keel petal, × 4; g, fruiting twig, ×1; h, seed, hilar view, × 8; i, seed, lateral view, × 8. a–f from *Willis s.n.* (MEL*1530210*); g from *Ross 3844*; h and i from *Ross 3845*.

Figure 12. *Bossiaea eriocarpa* – a, flowering twig, x 1; b, lower surface of leaf showing the secondary veins inserted almost at right angles to the midrib and all of the secondary veins and their branches terminating at the margin, x 4; c, calyx opened out (upper lobes on right), x 4; d, standard, x 4; e, wing petal, x 4; f, keel petal, x 4; g, fruiting twig, x 1; h, seed, hilar view, x 10; i, seed, lateral view, x 10. a–f from *Muir 3894*; g–i from *Ross 3820*.

pedicel, with pedicels 4–11 mm long, densely pubescent or villous; with the outer bract ovate to broadly ovate, up to 7.5 mm long and 5.5 mm wide, partially to entirely pubescent throughout externally or with marginal cilia only, persistent, the 2 innermost bracts narrowly ovate, 9.5–11.5 mm long, 3–7 mm wide, villous, longitudinally striate, enveloping the flower bud and bracteoles, caducous; bracteoles usually inserted a short distance below the calyx and overlapping the base, linear-oblong to narrowly ovate or elliptic, attenuate basally, 7.5–10 mm long, 1–1.7 mm wide, densely villous, usually caducous, concealed in bud by the 2 innermost bracts and often shed with them. Calyx densely pubescent or sericeous, all lobes of a similar length but the 2 upper lobes slightly broader than the lower lobes; 2 upper lobes 4.5–9.0 mm long excluding the tube 2–6 mm long, longer than the tube, acute or acuminate, 3 lower lobes 6.5–10 mm long, longer than the tube, acute or acuminate. Standard orbicular or depressed ovate, emarginate, 12.5–19.0 mm long including a basal claw 4–6 mm long, 14.3–21.3 mm wide, longer than the keel, yellow or orange-yellow internally with a reddish-brown margin and a reddish-brown or red horseshoe-shaped basal flare around a yellow throat, externally red or reddish-or purplish-brown, sometimes suffused with yellow basally; wings 11.3–14.1 mm long including a claw 2.0–3.5 mm long, auricled, 2.8–4.0 mm wide, externally red or reddish-brown; keel 10.2–13.2 mm long including a claw 3–4 mm long, auricled, 4.2–5.5 mm wide, usually distinctly fimbriate apically, externally red or reddish-brown, glabrous. Stamen-filaments 7.8–14.0 mm long. Ovary subsessile, 6.5–8.0 mm long, 6–12-ovulate, densely villous. Pods shortly stipitate, the stipe not or scarcely exceeding the calyx-tube, oblong, 2.0–3.5 cm long, 0.8–1.1 cm wide, densely villous. Seeds ellipsoid, 2.3–3.3 mm long, 1.3–2 mm wide, deep reddish-brown (Fig. 13).

Distribution and habitat: Occurs in the Darling Botanical District of the Southwestern Botanical Province from the Avon Valley National Park NE of Perth southwards to Augusta in the extreme south-west and south-eastwards to Albany and the Porongorups (Fig. 6). Recorded from gravelly clay, laterite and sandy loam in *Eucalyptus marginata-Corymbia calophylla* forest, *E. diversicolor* forest, *E. marginata/wandoo* woodland, and on sandy soil in *Eucalyptus/Banksia* woodland, heathland and *Hakea/Daviesia* scrub. A common understorey species and often locally dominant. Flowers Sept.–Nov.

Representative specimens (285 examined): 3.2 km NE of Kalgan on Albany-Esperance Rd, 30 Sept.1966, *T.B. Muir 3977* (MEL); Brockman Hwy at Blackwood River crossing near Alexandra Bridge, 21 Sept.1983, *J. Taylor 2047 & P. Ollerenshaw* (AD, CANB, MEL, PERTH); Mt Cooke, 28 Sept.1985, *M.G. Corrick 9583* (MEL, PERTH); Darling Range, Scrivener Rd., 1 km from its junction with the South-Western Hwy, 3 Oct.1985, *M.G. Corrick 9588* (MEL); Avon Valley National Park, near Bald Hill Lookout, 15 Oct.1985, *M.G. Corrick 9697* (MEL); Kojonup Wildflower Sanctuary, 15 Oct.1985, *M.G. Corrick 9645* (MEL, PERTH); Porongorup Range Scenic Drive, 18 Oct.1985, *M.G. Corrick 9696* (MEL).

Conservation status: Widespread and not under threat.

Notes: As indicated by Bentham (1864) and Wheeler (1987), *B. ornata* exhibits a great range of variation, especially in leaf shape and size. Considerable variation in leaf size and shape may be found on a single specimen which diminishes the utility of these characters. No meaningful way has been found of correlating the variation and consequently none of the variants encountered is accorded formal recognition here.

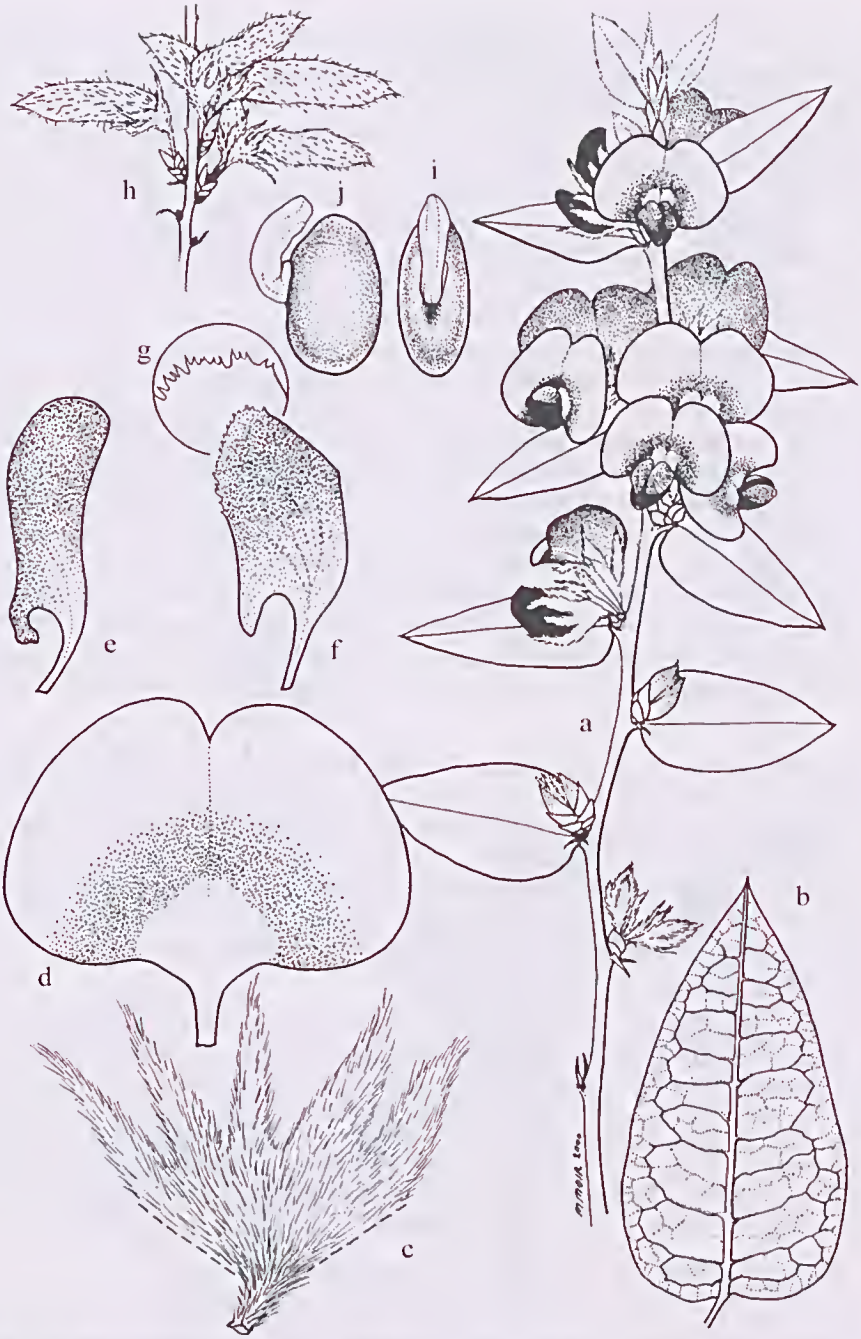

Figure 13. *Bossiaea ornata* – a, flowering twig, × 1; b, lower surface of leaf showing the conspicuous venation and the secondary veins branching just before they reach the margin and join adjacent veins before terminating at the margin, × 2; c, calyx opened out (upper lobes on right), × 4; d, standard, × 4; e, wing petal, × 4; f, keel petal, × 4; g, enlargement showing the distinctly fimbriate apex of the keel; h, fruiting twig, × 2; i, seed, hilar view, × 8; j, seed, lateral view, ×8. a–g from *Corrick 10551*; h from *Ross 2966*; i and j from *Kilgour 519*.

Coveny 8035 (PERTH), 5 Sept.1976, from Parkerville, has some very narrow leaves (1.5 mm wide) with recurved margins. The specimen looks superficially like *B. eriocarpa* but the leaves have the venation of *B. ornata*. Likewise, *Aplin 899* (PERTH) from Redhill on the Midland-Toodyay road has extremely narrow leaves.

Bossiaea ornata is usually readily distinguished from *B. eriocarpa* on the basis of leaf shape and size alone but specimens of *B. ornata* with atypically long narrow leaves are superficially similar to some specimens of *B. eriocarpa* with densely pubescent or villous calyces and atypically large leaves. The differences between the two species are given under *B. eriocarpa*. The fimbriate keel apices are characteristic of *B. ornata* although the utility of this character is diminished by the occasional presence of fimbriate keel apices in *B. eriocarpa*. *Bossiaea ornata* regenerates after fire by re-sprouting from a lignotuber.

A few collections from the south-eastern part of the distributional range are atypical in having glabrous calyces and pedicels. These specimens, for example, *A. Morrison s.n.* (PERTH) from south of Tenterden, 25 Sept.1902; *Woolcock s.n.* (MEL *651351*) from 28 km N of Albany, 11 Sept. 1982; *Woolcock s.n.* (MEL *2037756*) from Denbarker road, 40 km from Denmark, 6 Sept. 1982 and *V. Crowley DKN 232* (PERTH) from NW of Cordering, 16 Aug. 1993, have a somewhat different facies to typical *B. ornata*. In addition to having glabrous calyces and pedicels, the leaves are consistently small (up to 2.1 cm long and 1 cm wide), the venation is closely reticulate, and the keel petals are less conspicuously fimbriate than in typical *B. ornata* (Fig. 14). This variant is seldom collected and is poorly represented in herbaria. A search for specimens along Denbarker Road in 1996 was unsuccessful but at this location 'typical' *B. ornata* with pubescent calyces grew in profusion as a dominant understorey species. It is not known whether the variant with glabrous calyces and peduncles occurs sporadically amongst populations of 'typical' *B. ornata* or whether it has its own specific ecological preferences. The paucity of material makes an assessment of its status difficult. For the present, until its status can be ascertained, the specimens are included in *B. ornata*.

Newby 2980 (PERTH) from Bremer River has a similar facies to other collections of the variant discussed in the above paragraph but the pedicels and calyces are sparingly clothed with spreading hairs. The specimen is a reasonably good match of the type of *B. lalagoides* collected by Maxwell from Gardner River although the indumentum on the pedicels and calyces of the latter is denser and longer. However, the two localities are separated by a large disjunction. Bremer River is much further east than any known collection of typical *B. ornata* and geographically separated from them. The relationship of *Newby 2980* to the glabrous specimens referred to in the previous paragraph requires clarification, as does the status of these two entities.

Some specimens with long narrow leaves, for example, *B.J. Keighery & N. Gibson 362* (PERTH), *R.J. Cranfield 10789* (PERTH), have been segregated in PERTH as '*B.* sp. Waroona.' Although they fall within the range of morphological variation of *B. ornata*, they were collected from single-stemmed sparingly branched slender tall shrubs (G. Keighery, pers. comm.). These taller plants sometimes grow in fairly close proximity to the usual low multi-stemmed plants but there is a suggestion that their ecological preferences differ slightly. The specimens are reminiscent of *J. Drummond 253*, the type of *Lalage angustifolia* Meisn., and their status also requires clarification.

Figure 14. *Bossiaea ornata* – a, flowering twig, × 1; b, lower surface of leaf showing the conspicuous closely reticulate venation, ×3; c, calyx opened out (upper lobes on right), × 4; d, standard, × 4; e, wing petal, × 4; f, keel petal, × 4. a–f from *Woolcock s.n.* (MEL*2037756*).

Typification: Lindley indicated in the protologue of *Lalage ornata* that the illustration of the species 'was made in Mr Knight's Nursery in April last.' There is a sheet of material in CGE that is alleged to be type material. The large specimen on the right hand side of the sheet was collected by Drummond in 1839. As this was five years after the name was published, this specimen does not represent type material. Neither of the two smaller specimens on the left hand side of the sheet is labelled. Although these specimens may have been taken from the plant in cultivation in Knight's Nursery, there is no direct evidence to support this view and the leaves are not a good match of the plant depicted in Bot. Reg. 20: t.1722 (1834). This plate is sufficiently good to leave no doubt about the correct application of the name and consequently, I here select t.1722 in Bot. Reg. 20 (1834) as the lectotype of *Lalage ornata*.

No type specimen was cited in the protologue of *Lalage hoveifolia*. There is, however, a flowering specimen in Herbarium Benthamianum at K named 'Lalage hoveaefolia Benth.' bearing the printed label which reads 'Swan River, Drummond, 1839'. This specimen in K is here selected as the lectotype of *L. hoveifolia*. A Drummond specimen in CGE bearing a similar printed label is regarded as an isolectype. This latter specimen in CGE occupies a full sheet and is not to be confused with the Drummond specimen in CGE discussed in the previous paragraph that bears a similar printed label and is mounted on the right hand side of the sheet.

Meisner based his description of *Lalage stipularis* on *Preiss 1006*. I here select the specimen of *Preiss 1006* in LD as the lectotype of *L. stipularis*. The specimen consists of two young shoots arising from a rootstock following a fire. The young stems are densely clothed with spreading villous hairs, the leaves are extremely narrow (2.1–5.0 mm wide) and the upper and lower surfaces are also densely pubescent. The stipules are very prominent, whence the specific epithet. The leaf venation is that of *B. ornata* and the specimen is considered to represent an extreme narrow-leaved variant of this species.

The description of *Lalage angustifolia* Meisn. was based on *J. Drummond* [1st coll.] *253*. There does not appear to be a specimen of *Drummond 253* in Meisner's own herbarium in NY or in LD. I here select the specimen of *Drummond 253* in Herbarium Hookerianum in K as the lectotype of *L. angustifolia*. The lectotype is mounted on the right hand side of the sheet; on the left hand side is a specimen collected by Miss Bunbury in March 1887.

Mueller based his description of *Bossiaea lalagoides* on material collected from Gardner River by Maxwell. I have not succeeded in locating a Maxwell specimen from Gardner River bearing the name 'Bossiaea lalagoides' in Mueller's hand in K or MEL. There are a number of specimens in MEL bearing the name 'Bossiaea lalage F. Muell.' in Mueller's hand but none is from Gardner River. However, there is in MEL a sheet of Maxwell material labelled in Maxwell's hand 'On bluffs/ Gardner R/ Shrubs 2ft' bearing in Mueller's hand the name 'Bossiaea divaricata Turez.'. Similarly, there is in Herbarium Hookerianum in K a specimen labelled by Bentham 'Bossiaea divaricata Turez./Gardner river Maxwell/ Herb F. Mueller'. Written on the K sheet below this label in B.L. Burtt's hand is 'B. lalagoides F. Muell. Fragm. iv.12'. Presumably the K sheet is a duplicate of the MEL sheet. I had long wondered why Bentham, Fl. Austral. 2: 159 (1864), cited a Maxwell specimen from Gardner River under *B. divaricata* (a locality very far to the west of the known distribution of *B. divaricata*) and treated *B. lalagoides* as a synonym of *B. divaricata* Turez. It appears that he may have been misled by Mueller into doing so. A possible explanation for this may be found in the speed at which Bentham worked. In a letter to Mueller dated 12 October 1863, Bentham (1863b) wrote: 'I returned to work the first of this month and have done Dillwynia, Hovea and Bossiaea and its allies....'.

Mueller indicated in his protologue that the affinities of *B. lalagoides* were with *B. ornata* and *B. cinerea* R.Br. and that it had a facies reminiscent of *B. cinerea*, an eastern Australian species with which he was familiar. The affinities with *B. ornata* were confirmed by Mueller in a letter to Bentham dated 12 December 1863: 'In one of my last numbers of the Fragmenta you will observe, that I reduced Lalage ornata to Bossiaeae as B. ornata. I added an allied species, which may only be a variety namely Bossiaea lalagoides.' (Mueller, 1863).

The Maxwell material from Gardner River in K and MEL referred to above consists in each case of two flowering twigs in which the very young pods are starting to develop (Mueller mentioned that the fruits were unknown), has a facies reminiscent of *B. cinerea*, and generally matches the description in the protologue. The height of the plant described by Mueller 'Frutex circiter ulnaris, ...' accords precisely with the height given on Maxwell's label. As is to be expected, the two twigs on each sheet in K and MEL are shorter having been broken off a larger plant. The leaves on the Maxwell material are up to about 1 inch long as cited in the protologue; they exceed in length those recorded for *B. divaricata*. Despite the absence of the name *B. lalagoides* in Mueller's hand on either specimen, and despite the presence of the name *B. divaricata* Turez. in Mueller's hand on the MEL sheet, the above circumstantial evidence suggests

that these Maxwell specimens from Gardner River represent type material of *B. lalagoides*. It is difficult now to understand why the name 'Bossiaea divaricata' appears in Mueller's hand on the label of the MEL specimen, especially as he indicated in the protologue that the affinities of the species were with *B. ornata* and *B. cinerea*. Significantly the Maxwell material lacks the distinctive divaricate and pungent-pointed branches that characterise *B. divaricata*. Mueller would not have seen any authentic material of *B. divaricata* until after the publication of *B. lalagoides* in September 1863 and then must have concluded erroneously that his *B. lalagoides* was conspecific with the earlier *B. divaricata*. Mueller's first encounter with a specimen of *B. divaricata* would have been in 1866 when he acquired James Drummond's own set of specimens from his son, James Drummond Jr. In a letter to Bentham dated 5 February 1866, Mueller wrote 'Within the last week I have received Drummonds plants from Swan River. The collection is in a very miserable state; still it will complete what I have from W. Australia.' (Mueller, 1866).

In addition to the above specimens in K and MEL, there are in MEL three sheets (MEL *653728*, *653731*, *653732*) labelled in J.G. Luehmann's hand as having been collected by Maxwell in S.W. Australia but lacking any other locality information, and a sheet without a collector (MEL *105562*) labelled in Mueller's hand 'Bossiaea Lalage/S.W. Australia'. The K sheet and the four sheets in MEL are remarkably uniform and are possibly duplicates of the one collection.

On the basis of the above circumstantial evidence, and in the absence of any evidence to the contrary, I here select the Maxwell material in MEL (*105232*) from Gardner River bearing the name *B. divaricata* in Mueller's hand as the lectotype of *B. lalagoides* and the K sheet in Herbarium Hookerianum as an isolectotype. Mueller noted that the affinities of *B. lalagoides* were with *B. ornata* and *B. cinerea*, the description in the protologue falls within the range of variation of *B. ornata,* as does the specimen selected as lectotype. Bentham's treatment of *B. lalagoides* as a synonym of *B. divaricata* is in error. *Bossiaea lalagoides* is treated here as a synonym of *B. ornata*.

7. *Bossiaea* sp. Frankland (E.M. Sandiford 896)

Prostrate subshrub, young branchlets terete to oval in section, densely clothed with appressed to slightly spreading hairs. Leaves alternate, unifoliolate; lamina elliptic to almost rotund, 2.7–10 mm long, 2.5–8 mm wide, apex retuse, mucronate, upper surface shiny, sparingly to fairly densely clothed with appressed antrorse hairs up to 0.5 mm long, lower surface densely clothed with appressed antrorse hairs, with venation reticulodromous; petiole 1–2 mm long, densely clothed with appressed to slightly spreading hairs. Stipules obliquely narrowly ovate, sometimes slightly falcate, 1.5–3.1 mm long, conspicuously longitudinally striate, with conspicuous marginal hairs, longer than the petiole. Inflorescence solitary, with the pedicel 3.5–4.0 mm long, densely clothed with appressed to slightly spreading hairs; bracts scarious, longitudinally striate, glabrous apart from marginal and apical hairs; with outer basal bract ovate, up to 0.6 mm long, innermost bract narrow-ovate, 1.0–1.3 mm long; bracteoles narrow-ovate, up to 1.8 mm long, attached near the middle of the pedicel, scarious, longitudinally striate, persistent, glabrous apart from marginal and apical hairs. Calyx densely clothed with appressed antrorse hairs; 2 upper lobes up to 2.9 mm long excluding the tube 6 mm long, apices acute, diverging, 3 lower lobes up to 2 mm long, acute, shorter than the tube. Standard 6 mm long including a claw 1.6 mm long, 8 mm wide, broader than long, internally apricot with a basal red horseshoe-shaped flare around the throat; wings 5.4–5.8 mm long including a claw 1.1–1.4 mm long, 1.6–2 mm wide, apparently dark red; keel 6.0–6.2 mm long including a claw 1.5–1.7 mm long, 2.5–2.7 mm wide, apparently

pinkish-red, glabrous apically in the sinus. Stamen-filaments 3.9–5.2 mm long. Ovary up to 4 mm long, on a stipe up to 0.7 mm long, few-ovuled, densely clothed throughout with appressed antrorse hairs. Pods unknown (Fig. 15).

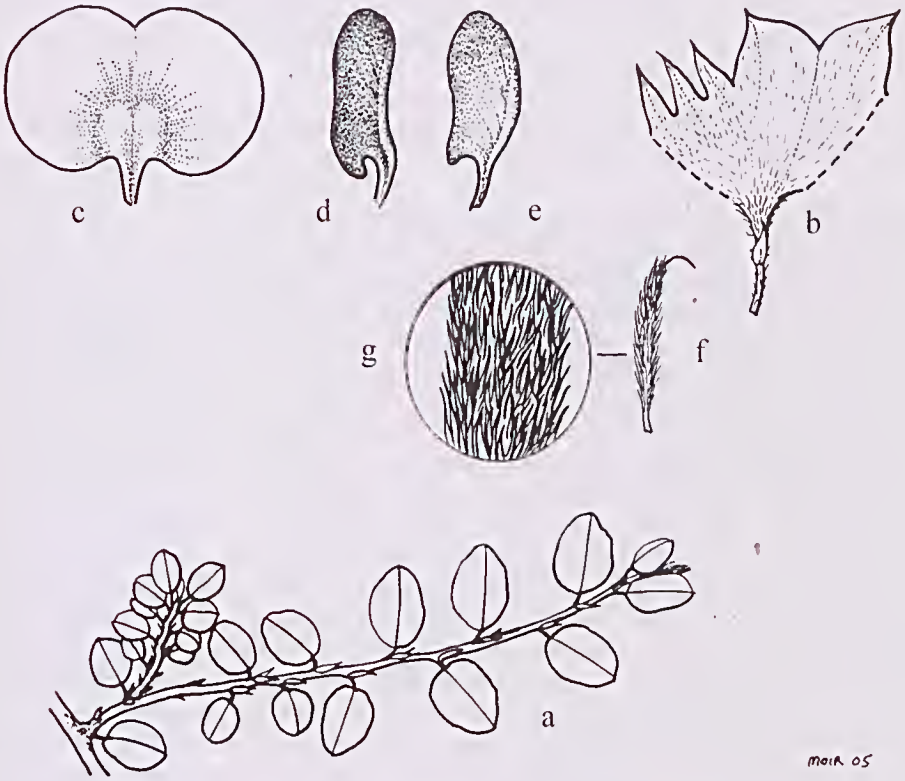

Figure 15. *Bossiaea sp.* Frankland (E.M.Sandiford 896) – a, vegetative twig, × 1; b, calyx opened out (upper lobes on right), × 4; c, standard, × 4; d, wing petal, × 4; e, keel petal, × 4; f, gynoecium, × 4; g, portion of ovary enlarged showing dense indumentum, × 20. a–g from *Sandiford 896*.

Distribution and habitat: Known from a solitary specimen collected W of Frankland in the Menzies subdistrict of the Darling Botanical District (Fig. 16). Collected from an area that had been previously grazed, logged and from which the undergrowth had been cleared, i.e., a highly modified habitat. Flowers Oct.

Specimen examined: NW Corner Nelson Loc. 354, N of Scrubiup Rd, ITC Duskwood Tree Farm, ca 17.5 km W of Frankland, 14 Oct.2003, *E.M. Sandiford 896* (ALBANY, MEL, PERTH).

Conservation status: CALM Conservation Code for Western Australia: Priority One. Inadequately known and described as 'rare'.

Notes: This taxon is unusual in being a prostrate subshrub and in having densely appressed-pubescent ovaries. Among the Western Australian species with alternate leaves, densely pubescent ovaries are found only in *B. eriocarpa*, *B. ornata*, *B. divaricata* and *B. spinosa*. Plants appear to produce very few flowers, although I have

Figure 16. Distribution of a, *Bossiaea* sp. Frankland (E.M. Sandiford 896); b, *B. divaricata*; c, *B. spinosa*; d, *B. modesta*; e, *B. linophylla*; f, *B. laxa.*

only seen one specimen. The taxon is possibly closest to *B. ornata* from which it differs in habit, in having much smaller, differently shaped and textured leaves, and smaller flowers. In general facies it is more reminiscent of an eastern species such as *B. prostrata* R.Br. than it is of the other Western Australian species.

I am reluctant to formally describe such a poorly understood taxon represented by one collection. More collections are desired.

8. *Bossiaea divaricata* Turcz., *Bull. Soc. Imp. Nat. Moscou* 26: 285 (1853). *Type*: 'Drum. V. n.83'; 1849, *J. Drummond 5th Coll. n. 83*; lecto.: KW (here selected); isolecto.: K, MEL *105910*, PERTH.

Low divaricately-branched rigid dense shrub to 0.5 m high and 1 m wide; young branchlets terete to slightly flattened, usually with an outer white waxy layer and appearing as though whitewashed, the waxy layer exfoliating to reveal a reddish-brown epidermis, usually sparingly to densely clothed with appressed antrorse or spreading hairs; the abbreviated lateral shoots usually terminating in a pungent point. Leaves alternate, unifoliolate; lamina narrowly ovate- or elliptic-oblong, 0.8–1.8 cm long, 0.25–0.6 cm wide, coriaceous, mucronate apically, with margins slightly thickened and recurved, upper surface usually clothed with appressed antrorse hairs when very young but becoming glabrous throughout or retaining a few scattered hairs along the midrib, often scabrous, shiny, lower surface usually covered with a whitish scurfy papillate layer and sparingly to densely clothed with appressed hairs, with venation semicraspedodromous; petiole 0.3–0.6 mm long, sparingly to densely clothed with spreading hairs. Stipules narrowly to broadly ovate, 2–4.5 mm long, 0.8–1.5 mm wide, much longer than the petiole, sometimes asymmetric basally and often laterally confluent, scarious, sparingly to densely pubescent, longitudinally striate, divergent, becoming reflexed apically, persistent. Flowers solitary, with pedicels 2.5–4.0 mm long, densely clothed with appressed antrorse or spreading hairs; bracts several, imbricate, broadly ovate, increasing in size up the length of the pedicel, the uppermost 1.5–3 mm long, 1.2–2.2 mm wide, brown, scarious, longitudinally striate, with marginal cilia and sometimes with scattered hairs towards the apex, persistent; bracteoles 2.8–3.5 mm long, 0.5–1.2 mm wide, inserted just above the bracts, brown, scarious, longitudinally striate, with marginal cilia and scattered hairs towards the apex, rapidly caducous. Calyx green basally on the lower surface, suffused with dark red elsewhere, densely clothed with spreading hairs; 2 upper lobes 2.5–3.5 mm long excluding a tube 2.4–3.6 mm long, acuminate, 3 lower lobes 2.3–3.7 mm long, 1.3–1.8 mm wide, acuminate, usually slightly longer than the tube. Standard 8–11 mm long including a claw 2.8–4.0 mm long, 8.0–12.2 mm wide, slightly longer than the keel, deep yellow internally with a red and/or reddish-brown horseshoe-shaped basal flare around a paler yellow throat, externally dark red or burgundy with a yellowish-brown margin; wings 7.0–9.5 mm long including a claw 2.0–2.8 mm long, 2.1–2.5 mm wide, externally pinkish-red basally passing to dark red or burgundy and yellowish-brown apically; keel 7.4–9.8 mm long including a claw 3–3.5 mm long, 2.8–3.7 mm wide, externally pinkish-red basally, dark red or burgundy apically, glabrous apically. Stamen-filaments 5.0–10.5 mm long. Ovary 5–6 mm long, on a stipe 1.2–2.2 mm long, 4–6-ovulate, densely villous. Pods 1.1–2.0 cm long, 0.4–0.6 cm wide, on a stipe not exceeding the calyx, dark brown, densely clothed with appressed hairs, inconspicuously transversely venose. Seeds 2.2–2.4 mm long, 1.6–1.8 mm wide, uniformly yellowish-brown (Fig. 17).

Distribution and habitat: Confined to the western portions of the Roe and Eyre Botanical Districts of the Southwestern Botanical Province where it is restricted

apparently to an area extending southwards from near Kukerin and Tarin Rock in the north-west to near Kojaneerup Springs and south-eastwards to Lake Magenta and Jerramungup (Fig. 16). Favours disturbed sites in gravel and clay soils in mallee or eucalypt woodland. Often found where the shrub understorey is sparse. Flowers Sept. to early Oct.

Representative specimens (20 examined): 29 km SE of Nyabing, 2 Sept.1962, *K. Newbey 404* (PERTH). Jerramungup, 15 Oct.1985, *J.H. Ross 3013* (MEL, PERTH). W boundary of Lake Magenta Nature Reserve, 23 July1992, *M.S. Graham 389* (PERTH). 20 km W of Lake Grace on Wagin-Lake Grace Rd, 1 Nov.1996, *M.G. Corrick 11478* (MEL, PERTH). 1 km E of Kukerin on Dumbleyung-Lake Grace Rd, 28 Sept.1998, *J.H. Ross 4042* (MEL, PERTH).

Conservation status: CALM Conservation Code for Western Australian Flora: Priority Four.

Notes: A distinctive species reminiscent of *B. eriocarpa* from which it is easily distinguished by being a more rigid divaricately-branched shrub with the abbreviated lateral branches usually terminating in a pungent point, the young branches usually with a much more conspicuous white waxy outer layer so that they appear whitewashed, different leaf venation and smaller flowers. It has a more easterly distribution. The pungent-pointed divaricate abbreviated lateral shoots also distinguish *B. divaricata* from *B. ornata*.

Bentham, Fl. Austral. 2: 159 (1864), cited *B. lalagoides* F. Muell. as a synonym of *B. divaricata* in error. *Bossiaea lalagoides* is a synonym of *B. ornata*.

9. *Bossiaea spinosa* (Turez.) Domin, Vestn. Kral. Ceske Spoleen. Nauk., Tr. Mat.-Prir. 1921-2: 39 (1923). *Platylobium spinosum* Turez., Bull. Soc. Imp. Nat. Moscou 26: 284 (1853). *Bossiaea calycina* Benth., Fl. Austral. 2: 159 (1864), nom. illegit. Type: 'Drum. V.n.84.'; 1849, J. Drummond 5th collection, No. 84; lecto.: KW (here selected); isolecto.: K, MEL 651103, PERTH.

Low rigid dense divaricate prostrate or rounded shrub to 0.4 m high; young branches terete, usually with an outer white waxy layer and appearing as though whitewashed, the waxy layer exfoliating to reveal a reddish- or greenish-brown epidermis, often fairly densely clothed with short spreading hairs; abbreviated lateral branches usually terminating in a pungent point, often slightly recurved or arcuate. Leaves alternate or sometimes appearing fascicled, unifoliolate; lamina ovate or elliptic, 2.3–6.0 mm long, 1.5–3.0 mm wide, acute or acuminate apically or sometimes depressed retuse, with margins not recurved, both surfaces but especially the lower with long scattered appressed antrorse or slightly spreading hairs when young, glabrescent or some hairs persisting, with venation often obscure but simple craspedodromous, lateral nerves almost at right angles to midrib; petiole 0.5–2.0 mm long, with long scattered appressed hairs when young, glabrescent or some hairs persisting. Stipules narrowly ovate, 1.2–2.6 mm long, 0.4–0.8 mm wide, longer than the petiole, spreading, often reflexed apically, longitudinally striate, with long marginal hairs and often a few scattered hairs along the midline, brown but becoming brownish-black with age, persisting. Flowers solitary, with pedicels up to 3.5 mm long, sparingly to densely clothed with appressed hairs; bracts ovate or elliptic, increasing in size up the length of the pedicel, the innermost similar to the bracteoles, 1.5–2.9 mm long, 0.7–1.6 mm wide, almost cymbiform, scarious, margins ciliate, persistent; bracteoles ovate, 1.8–3.5 mm long, 0.8–1.8 mm wide, usually inserted at or above the middle of the pedicel and overlapping the base of the calyx, scarious, slightly reflexed, with scattered long hairs on the surface and on the margins, persisting at least until the young fruits develop. Calyx green

Figure 17. *Bossiaea divaricata* – a, flowering twig, × 1; b, calyx opened out (upper lobes on right), × 4; c, standard, × 4; d, wing petal, × 4; e, keel petal, × 4; f, densely villous ovary, × 4; g, fruiting twig, × 1; h, seed, hilar view, × 10; i, seed, lateral view, × 10. a–f from *Ross 4032*; g from *Ross 4042*; h and i from *Ross 3883*.

suffused with pink or deep pinkish-red to purplish throughout; 2 upper lobes obovate, greatly enlarged relative to the lower 3 and sometimes longer than the standard, free on the upper side almost to the base, 7.0–9.5 mm long excluding a tube 1.6–3.0 mm long, 5–7 mm wide, sparingly to densely clothed with long appressed hairs to 1.5 mm long, with margins ciliate, conspicuously venose, apiculate, with 3 lower lobes longer than the tube, 5.0–6.5 mm long, 1.0–1.8 mm wide, acute or acuminate. Standard wider than long, 8.7–10.2 mm long including a claw 2.5–3.0 mm long, 10.3–12.5 mm wide, longer than the keel, internally deep yellow to orange with a pinkish-red horseshoe-shaped basal flare around a yellow throat, externally golden-yellow but suffused with pink basally; wings 7.5–9.0 mm long including a claw 1.4–1.6 mm long, 2.4–3.5 mm wide, externally pinkish-red basally, deep yellow apically; keel 7.4–8.8 mm long including a claw 2.0–2.6 mm long, 3.5–4.8 mm wide, externally pinkish-red basally, dark red or yellow apically, petals often lightly joined or free, glabrous apically. Stamen-filaments 5.8–9.0 mm long. Ovary 3.7–5.5 mm long, on a short stipe up to 0.5 mm long, densely clothed with long villous hairs, usually 4- or 5-ovulate. Pods 0.8–1.6 cm long, 0.45–0.7 cm wide, on a stipe usually shorter than the calyx-tube, densely villous. Seeds 2.0–2.5 mm long, 1.5–1.7 mm wide, uniformly pale yellowish (Fig. 9a, 18).

Distribution and habitat: Occurs in the Eyre and Roe Botanical Districts of the Southwestern Botanical Province and restricted to an area that extends south-eastwards from about 25 km west of Lake Grace in the north-west to Ongerup in the south and to near Ravensthorpe in the east (Fig. 16). Found in mallee or heath and often growing in laterite or sandy clay and gravel. Favours disturbed sites. Flowers Aug. to early Nov.

Representative specimens (15 examined): 53 km E of Pingrup, 5 Nov.1965, *A.S. George 7337* (PERTH). 25 km NE of Ongerup, 4 Sept.1974, *K. Newby 4334* (PERTH). Old Ongerup rd, 2 km E of Susetta R. crossing, 12 Sept.1983, *J. Taylor 1743* & *P. Ollerenshaw* (CANB, MEL, PERTH). 50 km E of Jerramungup on Hwy 1, 27 Sept. 1985, *M.G. Corrick 9564* (MEL). 24.4 km W of Lake Grace on Wagin-Lake King Rd, 1 Nov.1996, *M.G. Corrick 11477* (MEL, PERTH).

Conservation status: CALM Conservation Code for Western Australian Flora: Priority Four.

Notes: A very distinctive species that is distinguished readily by the two obovate upper calyx-lobes that are enormously enlarged relative to the 3 lower teeth, free on the upper surface almost to the base, and almost as long as or sometimes exceed the standard in length.

10. *Bossiaea modesta* J.H.Ross, *Muelleria* 8: 218 (1994). *Type*: Darling Distr., Darling Range, Mt Dale, 6 Nov. 1983, *M.G. Corrick 9020*; holo.: MEL *105671*; iso.: CANB, PERTH.

Subshrub to 0.5 m high, stems, wiry, lax, slender, trailing and twining and only erect when supported by surrounding plants, subterete basally but the extremities somewhat flattened, up to 2 mm wide, with a decurrent ridge below the point of insertion of each leaf, glabrous or with scattered hairs. Leaves alternate, unifoliolate; lamina linear- to elliptic- or obovate-oblong, 0.9–2.8 cm long, 2.5–6 mm wide, apex obtuse and mucronate, glabrous throughout or with occasional scattered hairs on margins and midrib, with margins slightly revolute, with venation semicraspedodromous; petiole 0.5–2.0 mm long, glabrous. Stipules obliquely triangular or subulate, 0.5–1.6 mm long, 0.2–0.4 mm wide, usually shorter than the petiole, glabrous throughout or with apical cilia. Inflorescence solitary, on filiform pedicels 1.2–2.5 cm long, pedicels glabrous throughout or with scattered hairs; the solitary basal bract oblong, 0.9–1.8 mm long,

Figure 18. *Bossiaea spinosa* – a, flowering twig, × 1; b, calyx opened out (upper lobes on right), × 4; c, standard, × 4; d, wing petal, × 4; e. keel petal, × 4; f, fruiting twig, × 1; g, seed, hilar view, × 12; h, seed, lateral view, × 12. a–f from *Ross 4039*; g and h from *Ross 3878*.

0.3–0.5 mm wide, clasping the base of the pedicel, scarious, glabrous apart from apical cilia, rapidly caducous when the buds are very young; bracteoles 0.8–1.6 mm long, 0.3–0.5 mm wide, inserted just below the calyx and usually overlapping the base of the calyx, scarious, glabrous or with scattered hairs, especially apically, persisting at least until the young fruits are initiated. Calyx glabrous externally apart from hairs on the margins of the lobes or with occasional scattered hairs; 2 upper lobes 1.2–1.9 mm long excluding the tube 2.8–3.5 mm long, truncate and the apices of the lobes diverging, acute, with 3 lower lobes triangular, 1.5–1.7 mm long, 1.0–1.1 mm wide, acute, shorter than the tube. Standard 9.8–10.0 mm long including a basal claw 2.8–3 mm long, 8.9–9.2 mm wide, longer than the keel, deep yellow internally with a deep red basal horseshoe-shaped flare around a paler yellow throat, externally with numerous red to purplish longitudinal striations radiating out from the base to the purplish margin giving a somewhat marbled appearance; wings 7.6–8 mm long including a claw 2.4–2.6 mm long, 1.9–2.1 mm wide, externally red; keel 8–8.3 mm long including a claw 2.8–3.3 mm long, 2.5–2.9 mm wide, externally greenish-white basally, red apically, with a dense woolly apical fringe of hairs. Stamen-filaments 6.2–8.2 mm long. Ovary 4.5–4.8 mm long, on a stipe 2.0–2.5 mm long, 6–8-ovulate, glabrous or with scattered hairs along the lower suture; style 1.7–2.0 mm long. Pods oblong, 1.3–2.3 cm long. 0.4–0.5 cm wide, on a stipe up to 1 cm long that greatly exceeds the calyx, valves thin, venation inconspicuous, glabrous. Seeds ellipsoid, 1.5–1.8 mm long, 1.0–1.3 mm wide, olive-brown.

Distribution and habitat: Confined to the Dale subdistrict of the Darling Botanical District. Apparently restricted to the Mt Dale area and NE of Mt Cuthbert in the Darling Range south-east of Perth (Fig. 16). Favours the banks of small creeks and damp sites in open *Eucalyptus marginata -Corymbia calophylla* forest with a rich understorey. Often found in association with *Xanthorrhoea preissii* Endl. Flowers Oct.–Dec.

Representative specimens (11 examined): Darling Range, Carinyah State Forest, Mt Dale, 10 Oct.1985, *M.G. Corrick 9646, 9647, 9648* (MEL, PERTH); 27 Nov.1992, *M.G. Corrick 10970A* (MEL); 20 Dec.1992, *M.G. Corrick 11025* (MEL); 12 Nov.1997, *J.L. Robson s.n.* (PERTH *5089727*).

Conservation status: CALM Conservation Code for Western Australia: Priority One. Known only from a few small populations, although it is possible that a thorough search will disclose further populations near some of the small creeks that feed into the Canning River. One of the populations appears to be at risk on account of trampling by walkers and being shaded out by maturing plants of the introduced *Eucalyptus grandis* W.Hill ex Maiden.

Notes: *Bossiaea modesta* is unusual amongst the Western Australian *Bossiaea* species in being a very weak-stemmed lax subshrub whose stems trail amongst the surrounding vegetation. It is an inconspicuous element of the understorey so easily overlooked. *Bossiaea rufa* and *B. praetermissa* sometimes grow as weak spreading shrubs with lax straggling stems but the plants are far more robust. *Bossiaea modesta* differs from *B. rufa* in having narrower wiry subterete stems (apart from the slightly flattened extremities up to 2 mm wide), much longer pedicels and persistent bracteoles. In *B. praetermissa* the calyx is usually densely clothed with short spreading hairs, the keel petals are typically glabrous apically in the sinus, and the pedicels are much shorter than in *B. modesta*.

11. *Bossiaea linophylla* R. Br. in W.T.Aiton, *Hortus Kew.* edn 2, 4: 268 (1812). *Type*: 'Nat. of the South West Coast of New Holland. Robert Brown Esq. Introd. 1803, by Mr Peter Good.'; *Brown '4829'*, leeto.: BM (here seleeted); isoleeto.: MEL *690319.*

Bossiaea linophylla var. *aurantiaca* Regel, *Gartenflora* 5: 367 (1856). Type not eited (see below).

Bossiaea linophylla var. *splendens* Regel, *Gartenflora* 5: 367 (1856) Type not eited (see below).

Spreading shrub to 3 m high, branehes typieally with a weeping habit; branehlets oval in seetion to slightly flattened and usually with a eonspieuous raised deeurrent ridge below the point of attaehment of eaeh leaf, up to 2 mm wide, glabrous to sparingly pubeseent. Leaves alternate or sometimes apparently in faseieles, unifoliolate; lamina linear, linear-oblong to narrowly ovate-oblong or oeeasionally obovate-oblong, (0.7–) 1.3–3 (–4) em long, 0.9–2 (–9) mm wide, apex obtuse or acute (emarginate in broad leaves), with margins slightly to distinetly reeurved, upper and lower surfaees glabrous throughout or with seattered hairs, midrib prominent on lower surfaee, with venation obseure but semieraspedodromous; petiole up to 1 mm long, glabrous to densely pubeseent. Stipules narrow-triangular or subulate, 0.7–2.2 (–3.5) mm long, usually longer than the petiole, searious, persistent, glabrous throughout or with marginal eilia. Flowers solitary, few together or pseudoraeemose and then axis densely pubeseent, the pedieels filiform, 0.5–1.4 em long, sparingly to densely pubeseent, seldom glabrous; braet solitary, basal, narrowly ovate, 0.5–1.0 mm long, elasping the pedieel, sparingly to densely pubeseent especially along the midline and apieally, rapidly eadueous when buds are young; braeteoles linear-oblong, 0.7–2.2 mm long, inserted in upper half of pedieel, often overlapping the base of the ealyx, often subopposite, searious, eadueous or persistent, with marginal and apieal eilia or sparingly pubeseent throughout. Calyx green apart from the red adaxial surfaee and tips of the three lower lobes, glabrous or with seattered appressed hairs; 2 upper lobes rounded-truneate, with the lobes diverging, 1.0–1.5 mm long exeluding the tube 2.0–3.2 mm long, with 3 lower lobes 0.9–1.3 mm long, aeute, shorter than the tube. Standard 6.6–9.7 mm long including a elaw 2.5–3.3 mm long, 7–11 mm wide, longer than the keel, bright yellow to orange or apricot internally with a basal red horseshoe-shaped flare around a greenish-yellow throat, externally red along the median line with red striations radiating into the yellow or orange margins; wings 6.4–8.3 mm long ineluding a elaw 1.8–2.7 mm long, 1.7–3.5 mm wide, externally pink or red basally, yellow apieally; keel 4.8–6.4 mm long ineluding a elaw 2.4–3.4 mm long, 1.6–2.7 mm wide, externally greenish basally, suffused with red elsewhere or red or erimson throughout, densely woolly pubeseent apieally in the sinus. Stamen-filaments 4.0–6.8 mm long. Ovary 2.1–3.5 mm long, on a stipe 1.2–2.2 mm long, 3- or 4-ovulate, glabrous throughout or with seattered hairs along one suture. Pods 0.9–1.7 em long, 0.4–0.7 em wide, on a stipe that exeeeds the ealyx, with valves glabrous, not eonspieuously venose. Seeds 2.4–2.9 mm long, 1.5–1.8 mm wide, dark blood-red when fresh, drying to purplish-blaek (Fig. 19).

Distribution and habitat: Oeeurs in the southern tip of the Drummond, Menzies and Warren subdistriets of the Darling Botanieal Distriet, the southern tip of the Avon Botanieal Distriet and the eastern edge of the Eyre Botanieal Distriet of the Southwestern Botanieal Provinee from the vieinity of Collie in the north, south-westwards to Angusta, south-eastwards through the Karri forests and along the south eoast to the vieinity of Warriup Hill NE of Albany and inland to the Stirling Range (Fig. 16). Found in *Eucalyptus marginata* and/or *Corymbia calophylla* woodland or forest, *E. diversicolor* forest, and low heath, usually in laterite, sand over laterite, sand or loam. Often a loeally dominant understorey speeies. Flowers Sept. to early Deeember.

A specimen collected by M. Koch in Oct. 1923 (MEL *667919*) is labelled as having been collected at Merredin. Merredin is so far outside of the known distributional range of the species and the habitat is so different that this alleged occurrence of it there is disregarded. It is more likely that the specimen was taken from a plant in cultivation or the label does not belong with the specimen.

Representative specimens (205 examined): 5 km ENE of Warriup Hill, 20 Sept.1976, *R. Story 8269* (CANB, MEL). One Tree Bridge on Donnelly River, 24 Oct.1983, *M.G. Corrick 8899* (CANB, MEL, NSW, PERTH). 5 km S of Margaret River township on Caves Rd, 28 Oct.1983, *M.G. Corrick 8958* (CANB, MEL, PERTH). Stirling Range National Park, 2 km N of Toolbrunup turn-off at start of Mt James Track, 16 Oct.1985, *M.G. Corrick 9675* (MEL). Porongorup Range Scenic Drive, 18 Oct.1985, *M.G. Corrick 9692* (MEL). Glen Mervyn Dam, 22 Oct.1985, *M.G. Corrick 9731* (MEL).

Conservation status: Widespread and not threatened.

Notes: *Bossiaea linophylla* is a member of the small group of unarmed (lacking pungent-pointed abbreviated lateral shoots) species with alternate leaves, ovaries that are glabrous throughout or with scattered hairs along one or both sutures, and keel petals that are densely woolly-pubescent apically in the sinus. *Bossiaea linophylla* is allied to *B. laxa* which also grows as an erect shrub with somewhat weeping branches, but differs from it in having smaller flowers, differently coloured petals, shorter pods and different coloured seeds.

Bossiaea linophylla is an attractive graceful shrub. It exhibits a considerable amount of variation in leaf size, especially in leaf width, and in flower colour. In most *Bossiaea* species, the bracteoles on the pedicel are either uniformly caducous or uniformly persistent but in *B. linophylla* both conditions occur.

In contrast to the other species, the young seeds in *B. linophylla* are blood-red and mature to a purplish-black.

Typification: It is not clear whether R.Brown based his description of *B. linophylla* on a plant raised at Kew Gardens from seed collected by Peter Good or himself in Western Australia, whether the description was based on his own specimens collected in Australia, or whether it was based on material in cultivation and on herbarium specimens. There is in BM a sheet of material which bears in the top left hand corner a blue printed J.J. Bennett 'Iter Australiense' label to which the number 4829 has been assigned. Superimposed on this label is a white one which reads '~~Pultenaea~~ sp./ Bossiaea linophylla/ Kew Gardens 1807-8 from Seeds/ of King Georges Sound/ New Holland'. Below this blue label is a white label in Brown's hand which reads 'Pultenaeastrum ? angustifolium/ King G III^{d} Sound/ Dec. 1801'. Three specimens are mounted on the sheet, but there is no means of knowing which label belongs with which specimen on this composite sheet. The specimen mounted on the right hand side of the sheet and the specimen above it running almost diagonally across the sheet appear to represent one collection. Each of the two specimens bears flowers or very young fruits and the leaves are narrow and almost linear. The specimen in the bottom left hand corner bears mature fruits, has much broader leaves, and clearly represents another collection. It is tempting to speculate that the fruiting specimen was collected in the wild and that the two flowering specimens are from cultivation. The protologue reads '.... ramis foliosis compressis, foliis linearibus; marginibus recurvis, legumine uniloculari, ...'which suggests that the description was possibly based on both collections. Linear leaves are best exemplified by the flowering material and consequently the flowering material is selected here as the lectotype of *B. linophylla*. The Brown specimen in MEL to which the number 4829 was assigned by Bennett has

written on the label 'King G iii Sd'. The specimen has linear leaves, flower buds and a few post-mature flowers, and is treated here as an isolectotype.

The varieties *aurantiaca* Regel and *splendens* Regel were based on differences in flower colour observed in plants in cultivation. In var. *aurantiaca* the base of the standard was described as a beautiful orange and the wing petals bright orange-brown, whereas in var. *splendens* the standard was described as orange-red internally and even redder externally and the wing petals coloured as in var. *aurantiaca*. I have not succeeded in locating type material of either. Given the natural range of variation in flower colour within the species, these varieties are not considered to be worthy of retention and they have been relegated to synonymy. I have not nominated neotypes for these varieties as I do not have access to a range of living flowering material from which to make a selection and the collecting notes accompanying herbarium specimens do not provide an adequate indication of the precise colour of the individual corolla parts for this purpose.

12. Bossiaea laxa J.H.Ross, sp. nov.

B. linophyllae R.Br. affinis, a qua floribus grandioribus, petalis carinae pallidis viridi-flavis, bracteolis semper cito caducis, leguminibus grandioribus, differt.

Type: Western Australia, Coolgardie Distr., Cave Hill Reserve, NW of Norseman, 20 May 2003, *M. Hislop & F. Hort 3204*; holo.: PERTH; iso. MEL *2280356*.

Lax, open many-stemmed spreading shrub to 2 m high, young branches typically with a weeping habit; branchlets oval in section to flattened and usually with a conspicuous decurrent ridge below the point of attachment of each leaf, up to 1.5–2 (–3.5) mm wide, almost completely glabrous except for hairs in the axils of the stipules and occasional scattered hairs. Leaves alternate, unifoliolate; lamina linear to linear-oblong or narrowly obovate-oblong, 1.0–3.2 cm long, 0.7–2.5 (–4.0) mm wide, apex obtuse, rounded or occasionally slightly emarginate, upper and lower surfaces usually glabrous throughout but occasionally with scattered hairs especially on the lower surface, with margins slightly revolute, midrib prominent on lower surface, with venation semicraspedodromous; petiole 0.6–2.0 mm long, glabrous. Stipules narrow-triangular or triangular, 1.0–1.5 mm long, scarious, shorter or longer than the petiole, glabrous, inconspicuously longitudinally striate, persistent. Inflorescence solitary or pseudoracemose, on filiform pedicels 0.7–2 cm long, green throughout or suffused with red apically, glabrous or with occasional scattered hairs especially above the point of attachment of the bracteoles; solitary basal bract oblong, up to 1 mm long, scarious, glabrous apart from marginal and apical hairs, rapidly caducous when buds are very young; bracteoles oblong, 1.0–2.4 mm long, usually inserted in upper half of the pedicel, scarious, glabrous apart from marginal, basal and apical hairs, usually persisting until the young pods develop but sometimes caducous. Calyx green but the median line of the upper lobes and the apices of all lobes dark purplish-red, glabrous externally apart from hairs on the margins of the lobes or with occasional scattered hairs; 2 upper lobes 1–2 mm long excluding the tube 4.6–5.5 mm long, apices of lobes rounded, with 3 lower lobes triangular, 1.1–1.6 mm long, acute, shorter than the tube. Standard 12–16 mm long including a basal claw 2.5–4.5 mm long, 10–16 mm wide, about as long as the keel but sometimes slightly shorter, bright yellow internally with a faint red horseshoe-shaped basal flare around a paler greenish-yellow throat or sometimes the red flare lacking, often with hairs apically in the sinus, externally paler yellow with numerous red to purplish longitudinal striations radiating into the lamina from and near the base giving a somewhat marbled appearance when young; wings 9.5–

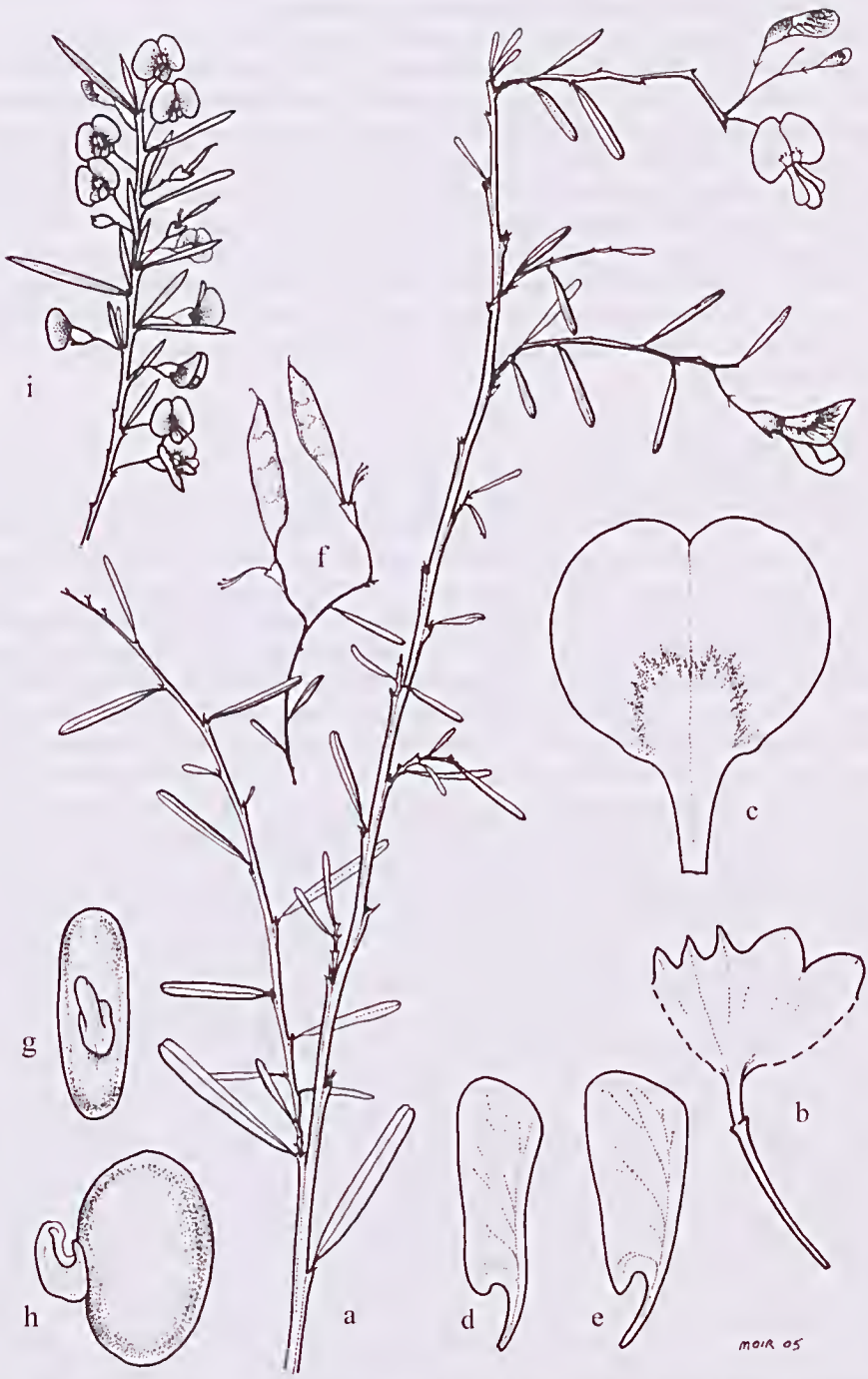

Figure 19. *Bossiaea laxa* – a, flowering twig, × 1; b, calyx opened out (upper lobes on right) × 4; c, standard, × 4; d, wing petal, × 4; e, keel petal, × 4; f, fruiting twig, × 1; g, seed, hilar view, × 10; h, seed, lateral view, × 10. *Bossiaea linophylla* – i, flowering twig, × 1. a–h from *Hislop & Hort MH3204*; i from *Corrick 8958*.

13.5 mm long including a claw 2.6–3.5 mm long, 2.5–4.0 mm wide, yellow throughout or tinged with red basally; keel 10.1–14.5 mm long including a claw 3.2–4.1 mm long, 3.3–5.1 mm wide, pale greenish-yellow, with a dense woolly apical fringe of hairs on the lobes and in the sinus. Stamen-filaments 8.2–13.0 mm long. Ovary 5.8–9.0 mm long, on a stipe 1.5–2.7 mm long, 6–8-ovulate, glabrous apart from hairs along the lower suture and occasional scattered hairs on the valves. Pods oblong, 2.1–3.0 cm long, 0.45–0.5 cm wide, on a stipe up to 3 mm long that exceeds the calyx, with valves thin, venation inconspicuous, glabrous apart from scattered hairs along the lower sutural margin. Seeds ellipsoid, 2.4–3.5 mm long, 1.4–2.3 mm wide, uniformly pale brown (Fig. 19).

Distribution and habitat: Apparently confined to the Cave Hill Reserve, NW of Norseman in the Coolgardie Botanical District (Fig.16). Favours brown loam over deep granite in *Allocasuarina huegeliana* (Miq.) L.A.S.Johnson/*Acacia lasiocalyx* C.R.P.Andrews woodland. Flowers May.

Specimens examined: Cave Hill Reserve, 50 km S of Widgiemooltha, 29 May 2005, *B. Archer 2541* (CANB, K, MEL, PERTH); *2543* (MEL, PERTH).

Conservation status: CALM Conservation Code for Western Australia: Priority Two. A small population of scattered plants occurs in a very restricted area in the Cave Hill Reserve. Uncommon. Plants occur on a W-facing slope in a sheltered position at the base of a granite outcrop. Seedling recruitment was evident in May 2005 (B. Archer, pers. comm.).

Notes: *Bossiaea laxa* is a member of the small group of unarmed (lacking pungent-pointed abbreviated lateral shoots) species with alternate leaves, ovaries that are glabrous throughout or with scattered hairs along one or both sutures, and keel petals that are densely woolly apically in the sinus. *Bossiaea laxa* is allied to *B. linophylla* but differs in having larger flowers with pale greenish-yellow keel petals, and longer pods with pale brown seeds. In addition, the ecological preferences of *B. laxa* and *B. linophylla* are quite different, and they are separated by a large geographical discontinuity. *Bossiaea laxa* is reminiscent of *B. modesta* from which it differs in being a large erect lax shrub and in having narrower usually linear to linear-oblong leaves, larger flowers and seeds, and different ecological preferences.

Some of the flowers in *Archer 2543* are malformed and have a second much reduced second standard up to 6.5 mm long and 8.0 mm wide fused to the upper lobes of the calyx.

Etymology: From the Latin *laxa*, loose; in reference to the open growth form of the species.

13. *Bossiaea disticha* Lindl., *Edwards's Bot. Reg.* 27: 38 (May 1841); t.55 (Oct. 1841). *Type*: 'A very pretty Swan river shrub,.....It has flowered in the Garden of the Horticultural Society.'; lecto.: CGE (here selected).

Slender weak shrub to 1.5 m high, often single-stemmed, branchlets slender, terete to oval in section or slightly flattened, clothed with appressed antrorse or long spreading hairs or a mixture of both. Leaves alternate, unifoliolate; lamina oblong, linear-oblong or ovate-oblong, (0.4–) 1.0–2.0 cm long, 1.7–7.0 mm wide, apex obtuse or rounded but often mucronate, with margins slightly revolute, upper surface with scattered appressed antrorse hairs, lower surface densely clothed with appressed antrorse hairs, with venation simple craspedodromous or semicraspedodromous; petiole up to 1 mm long,

densely clothed with spreading hairs. Stipules up to 1.8 mm long, narrowly ovate, longer than the petiole, green when young but becoming scarious, longitudinally striate, persistent, with margins ciliate. Flowers solitary or paired, sometimes pseudoracemose, with the pedicels 7–14 mm long, densely clothed with appressed to slightly spreading hairs; bracts ovate, 0.7–1.8 mm long, 0.3–0.5 mm wide, longitudinally striate, with scattered hairs on the midline especially towards the apex, scarious, usually rapidly caducous; bracteoles narrowly ovate or ovate, 1–2 mm long, 0.4–1.0 mm wide, overlapping the base of the calyx in bud but not or scarcely in mature flowers, scarious, longitudinally striate, with scattered hairs on the margins and on the midline especially towards the apex, invariably persisting at least until the young pods develop. Calyx green but suffused with red, especially on the lobes, sparingly to densely clothed with appressed or spreading hairs; 2 upper lobes 2.2–2.7 mm long excluding the tube 2.8–3.7 mm long, rounded or obtuse, the apices diverging, acute, with 3 lower lobes 1.5–2.8 mm long, acute, shorter than the tube. Standard 10.0–13.5 mm long including a claw 3.0–3.5 mm long, 12.0–15.2 mm wide, usually wider than long, longer than the keel, bright yellow internally with a red and/or purplish-brown horseshoe-shaped zone around a basal greenish-yellow throat, externally pale yellow but suffused with red striations radiating out from the base or predominantly purplish-brown; wings 11.2–11.4 mm long including a claw 2.7-2.8 mm long, 3.0–3.5 mm wide, red or purplish-brown basally, yellow apically or predominantly purplish-brown throughout; keel 10.3–11.0 mm long including a claw 3.5–3.6 mm long, 3.5–4.0 mm wide, greenish-white except for a red apex and margin, glabrous apically. Stamen-filaments 8.5–11.2 mm long. Ovary 4.8–5.5 mm long, on a stipe 1.5–2 mm long, 4–8-ovulate, glabrous apart from dense villous hairs along the sutures and sometimes with scattered hairs towards the apex. Pods shortly stipitate, the stipe shorter than or scarcely exceeding the calyx, oblong, 1.5–2.2 cm long, 0.6–0.8 cm wide, with margins slightly thickened, not conspicuously venose, glabrous apart from scattered long hairs on the margins. Seeds 2.1–2.6 mm long, 1.3–1.6 mm wide, uniformly yellow-brown (Fig. 20).

Distribution and habitat: Confined to the Warren Subdistrict of the Southwestern Botanical Province where it occurs from Ellen Brook in the north to Cape Leeuwin along the southern half of the Leeuwin-Naturaliste Ridge (Fig. 21). Found in *Eucalyptus diversicolor* forest, *Corymbia calophylla* forest, low forest or woodland and granite heath in well-drained loam or granitic soils (Keighery 1996). Locally common and often a dominant understorey species. Distribution is limited mainly by soil type and rainfall. Flowers Sept.–Oct.

Representative specimens: (20 examined): Karridale, 24 Oct.1953, *R.D. Royce 4672* (PERTH). 27 km N of Augusta on Boranup Drive, 26 Oct.1983, *M.G. Corrick 8928* (AD, BRI, CANB, HO, MEL, NSW, PERTH). Caves Rd, 1 km N of Ellen Brook, Margaret River to Yallingup, 5 Oct.1986, *G.J. Keighery 9192* (PERTH). Wilderness Drive, Prevelly Park, 8 km W of Margaret River, 5 Oct.1987, *G.J. Keighery 9195* (PERTH).

Conservation status: CALM Conservation Code for Western Australia: Priority Four

Notes: Keighery (1996) reported the existence of two distinct colour forms. In the northern populations in the Ellen Brook area the flowers exhibit a greater proportion of brown in relation to the bright yellow, whereas in the more widespread southern populations the bright yellow predominates. Both colour forms are reported to be pollinated by the same suite of solitary bees.

Keighery (*l.c.*) indicated that plants are killed by fire and that the seeds germinate in profusion the following winter to produce dense even-aged stands. Maximum seed production is reached 5 to 7 years after a fire.

Easily distinguished from the other unarmed species with alternate leaves, ovaries with scattered hairs along the sutures, and glabrous keel petals, by having oblong, linear-oblong or ovate-oblong leaves that are appressed pubescent on both surfaces, and flowers on long pedicels.

Typification: There is in Lindley's herbarium in CGE a sheet consisting of a flowering branch that had been identified previously as type material of *B. disticha*. Written on the sheet at the base of the twig and to the right are three initials that I cannot decipher. In terms of leaf size and shape and the flowers, the specimen agrees reasonably well with the plant depicted in the plate (t.55) in Bot. Reg. 27 (1841). This specimen may well have been taken from the plant depicted in the protologue and, in the absence of evidence to the contrary, I here select it as the lectotype of *B. disticha*. Should evidence materialise that the specimen was collected subsequent to the publication of the protologue, t. 55 in Bot. Reg. (Oct. 1841) will suffice to fix the application of the name *B. disticha*.

Drummond 122, represented in a number of herbaria including LD, MEL, NY, PERTH, has sometimes been treated as the type. This is not the case as the description was said to be based on a cultivated specimen.

14. *Bossiaea peduncularis* Turcz., *Bull. Soc. Imp. Nat. Moscou* 26: 287 (1853). *Type*: 'Drum. Coll. V. n. 80.'; 1849, *J. Drummond, 5th coll. n. 80*; lecto.: KW (here selected); isolecto.: MEL *105913*, PERTH.

Dense divaricately-branched weak shrub to 1 m high and 3 m wide; young branches slender, terete to oval in section, sparingly to densely clothed with appressed antrorse hairs, the abbreviated lateral shoots terminating in a pungent point. Leaves alternate, unifoliolate; lamina oblong to elliptic-oblong or occasionally slightly obovate-oblong, (2.5–) 3.5–8.0 mm long, 1.3–2.1 (–2.5) mm wide, obtuse apically, upper surface glabrous or with scattered appressed antrorse hairs, lower surface sparingly to densely clothed with appressed antrorse hairs, with margins slightly recurved, with venation usually inconspicuous, simple craspedodromous; petiole 0.5–1.0 mm long, densely pubescent. Stipules narrow-triangular, 0.7–1.8 mm long, 0.25–0.4 mm wide, longer than the petiole, brown, scarious, often confluent basally, spreading and often recurved apically, persistent, sometimes with scattered marginal hairs or a few hairs towards the apex. Flowers solitary, the pedicels filiform, 0.8–1.3 cm long, usually inserted well above the axils, red, sparingly to densely clothed with appressed antrorse hairs; bract solitary at the base of the pedicel, narrowly ovate, 0.6–1.4 mm long, brown, scarious, with marginal cilia and scattered hairs along the midline towards the apex, rapidly caducous and evident in only the youngest of buds; bracteoles elliptic-oblong, 1.0–1.4 mm long, 0.3–0.4 mm wide, inserted above the middle of the pedicel and overlapping the base of the calyx in bud, brown, scarious, with marginal cilia and scattered hairs externally, usually persisting until the pods mature. Calyx sparingly to densely clothed externally with appressed antrorse hairs; 2 upper lobes 1.6–2.2 mm long excluding a tube 1.2–2.5 mm long, 1.3–1.7 mm wide, broader but otherwise scarcely differentiated from the 3 lower lobes, green with red striations, rounded-truncate, apices diverging, acute, with 3 lower lobes 1.6–3.2 mm long, 0.7–1 mm wide, acuminate, longer or shorter than the tube, green throughout or tips of lobes red. Standard 6.5–8.2 mm long including a claw 1.2–1.6 mm long, 7–8.5 mm wide, sometimes shorter than the keel, pale yellow throughout or with a basal red flare internally, externally yellow suffused with pink and with red longitudinal striations radiating from the base along the median line; wings 5.1–6.5 mm long including a claw 0.8–1.5 mm long, 1.3–1.7 mm wide,

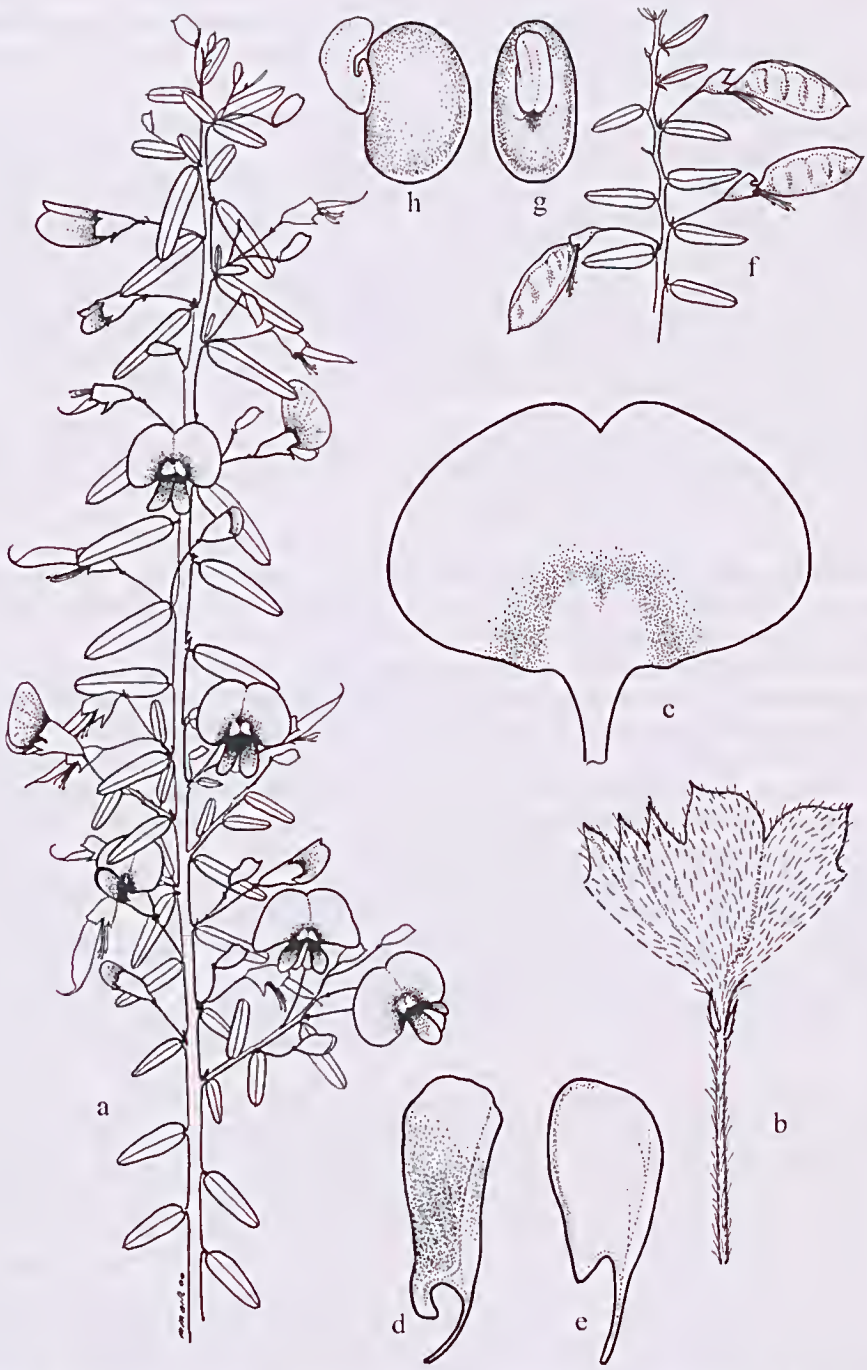

Figure 20. *Bossiaea disticha* – a, flowering twig, × 1; b, ealyx opened out (upper lobes on right), × 4; e, standard, × 4; d, wing petal, × 4; e, keel petal, × 4; f, fruiting twig, × 1; g, seed, hilar view, × 10; h, seed, lateral view, × 10. a–e from *Ross 3956*; f–h from *Corrick 8928*

Figure 21. Distribution of a, *Bossiaea disticha*; b, *B. peduncularis*; c, *B. arcuata*; d, *B. smithiorum*; e, *B. barbarae*; f, *B. preissii*.

Figure 22. *Bossiaea peduncularis* – a, flowering twig, × 1; b, lower surface of leaf clothed with appressed antrorse hairs, × 10; c, flowering twig showing pedicel inserted well above the leaf axil, × 5; d, calyx opened out (upper lobes on right) and the persistent bracteoles attached near the apex of the pedicel and overlapping the base of the calyx, × 4; e, standard, × 4; f, wing petal, × 4; g, keel petal, × 4; h, fruiting twig, × 1; i, seed, hilar view, × 10; j, seed, lateral view, × 10. a–g from *Ross 3887*; h–j from *Ross 3893*.

shorter than the keel, auricled, externally pale yellow throughout or sometimes with a longitudinal red striation near the lower margin and more or less parallel to it; keel 6.5–7.2 mm long including a claw 1.3–1.8 mm long, 2.6–3.2 mm wide, externally pale greenish-yellow, densely pubescent or woolly apically in the sinus. Stamen-filaments 5.6–7.1 mm long. Ovary 4–5 mm long, on a stipe 1–2 mm long, 4–6-ovulate, glabrous apart from scattered cilia on the lower suture. Pods 1.2–2 cm long, 0.4–0.5 cm wide, on a stipe just exceeding the calyx, margins slightly thickened, with valves inconspicuously venose, glabrous apart from scattered hairs along the lower suture and on the surface. Seeds 1.9–2.8 mm long, 1.3–1.7 mm wide, uniformly pale brown (Fig. 22).

Distribution and habitat: Confined to the western portion of the Roe Botanical District of the Southwestern Botanical Province where it is known from several disjunct localities from Lake Kondinin in the north, southwards to Lake Anderson and south-eastwards to east of Jerramungup (Fig. 21). Recorded growing in association with mallee and *Melaleuca* spp. in deep sand near the perimeter of salt lakes and in sandy loam in disturbed mallee. Flowers Oct.

Representative specimens (12 examined): Jaeup, near Jerramungup, Oct.1968, *O.M. Goss s.n.* (PERTH *00456284*). W edge of Reserve No. 18803, 15 km W of Pingrup, 17 Jan.1978, *J.M. Koch N24* (PERTH). Lake Anderson, 15 Oct.1985, *M.G. Corrick 9668* (MEL, PERTH). 6.7 km SE of Ongerup, 16 Oct.1985, *J.H. Ross 3035* (MEL, PERTH).

Conservation status: CALM Conservation Code for Western Australian Flora: Priority Two. Seldom collected and usually present in low numbers except for the Lake Anderson population.

Notes: Easily distinguished from the other spinescent species with glabrous ovaries (apart from scattered hairs on the margins) and keel petals densely pubescent apically by the long filiform pedicels that typically are inserted some distance above the axils. The differences between *B. peduncularis* and *B. arcuata* are discussed under the latter.

15. *Bossiaea arcuata* J.H.Ross, *sp. nov.*

B. pedunculari Turcz. affinis, a qua planta multo largiore fere aphylla, foliis glabris, floribus grandioribus, calycibus glabris, bracteolis caducis cito, differt.

Type: Western Australia, Coolgardie District, Keys Rocks area, 21.5 km SW of Norseman P.O., 25 Sept. 2000, *J.H. Ross 4105* & *B. Archer*, holo.: PERTH; iso.: CANB, K, MEL *2149955*, NSW.

Erect divaricately branched superficially leafless shrub to 1.5 m high and 2 m wide, almost completely glabrous except for scattered hairs on the young growth; branchlets terete or oval in section, often arcuate, ultimate branches of cladodes 0.7–1.0 mm wide, not winged or notched at the nodes, longitudinally striate, terminating in a weak pungent point, new growth pinkish, growth of current season greyish-green, older growth usually with a thin inconspicuous whitish waxy layer that exfoliates ultimately. Leaves alternate, unifoliolate, few, inconspicuous, confined to the very young growth and rapidly caducous, the plants superficially apparently leafless; lamina 3.6–10.5 mm long, 1.3–3.0 mm wide, oblanceolate-oblong, rounded apically or slightly depressed-retuse, slightly concave on upper surface, with margin flat, glabrous apart from small scattered hairs on the midrib on the lower surface and sometimes on the margins, with venation indistinct, semicraspedodromous; petiole 0.5–1.5 mm long, glabrous. Stipules ovate, 0.4–1.6 mm long, 0.3–0.4 mm wide, laterally confluent basally, pinkish-red when young but turning dark brown, with marginal and apical cilia, often reflexed apically, persistent. Flowers solitary at the nodes or more usually pseudoracemose, the pedicels

5.5–13 mm long, sometimes inserted well above the axils, glabrous or with occasional scattered hairs when young; bract solitary at the base of each pedicel, ovate or ovate-oblong, 0.4–1.2 mm long, dark reddish-brown, with marginal cilia and hairs along the midline especially apically, rapidly caducous and only evident in very young bud; bracteoles ovate-oblong or elliptic-oblong, 0.7–1.4 mm long, usually inserted above the middle of the pedicel, overlapping the base of the calyx in young bud but rapidly caducous, scarious, not conspicuously longitudinally striate, with or without marginal cilia but hairs prominent apically. Calyx green but the upper lobes suffused with pink or red, glabrous throughout externally apart from hairs on the margins of the lobes and sometimes with occasional scattered hairs on the lobes; 2 upper lobes rounded-truncate, 1.3–2.1 mm long excluding the tube 3.5–4.6 mm long, with 3 lower lobes 1.4–1.9 mm long, shorter than the tube, acute. Standard 10.5–13.0 mm long including a claw 3.7–4.8 mm long, 9.0–10.2 mm wide, slightly longer than the keel, deep yellow internally with a basal red horseshoe-shaped flare around the throat, yellow externally apart from red longitudinal striations radiating from the base into the lamina; wings about as long as the keel, 9.2–10.8 mm long including a claw 2.8–3.5 mm long, 1.6–2.8 mm wide, red basally and deep yellow above; keel 9.8–11.0 mm long including a claw 3.3–4.2 mm long, 3.1–4.0 mm wide, pale greenish-yellow throughout or sometimes with a red-brown longitudinal striation towards the lower margin and more or less parallel to it, with woolly hairs apically in the sinus. Stamen-filaments 7.1–11.0 mm long. Ovary 5.8–8.0 mm long, on a stipe 1.6–3.6 mm long, 6- or 7-ovulate, glabrous throughout or with scattered hairs on the lower suture; style 2.7–3.8 mm long. Pods oblong, 1.4–2.1 cm long, 0.4–0.5 cm wide, stipe longer or shorter than the calyx, with valves pinkish-brown when young but fawn at maturity, transverse venation inconspicuous, glabrous. Seeds elliptic-oblong, 1.9–2.9 mm long, 1.3–1.5 mm wide, a uniform pale fawn but suffused with a pinkish tinge (Figs. 9e, 23).

Distribution and habitat: Confined to the southern portion of the Coolgardie Botanical District where it is restricted to the Pienic Lake area SW of Norseman (Fig. 21). Occurs in deep white sand on the perimeter of the salt lake. Associated with *Melaleuca acuminata* F. Muell. subsp. *acuminata, M. exuvia* Craven & Lepschi, *M. hamulosa* Turez., *M. subalaris* Barlow, *Eucalyptus* spp., *Carpobrotus* sp., *Santalum acuminatum* (R.Br.) A.DC. and *Alyxia buxifolia* R.Br. Flowers March–April, September–October. The March–April flowering in 2000 followed a cyclone at the beginning of the year which resulted in abnormally high rainfall for that time of the year: September–October is probably the usual flowering time.

Representative specimens (10 examined): Coolgardie Distr., Pienic lake, 27 km SW of Norseman P.O., 9 Apr. 2000, *B. Archer 1537* (MEL, NSW, PERTH). Keys Rocks area, 21.5 km SW of Norseman P. O., 10 Apr. 2000, *B. Archer 1541* (MEL, PERTH); 22 Apr. 2000, *B. Archer 1560* (AD, MEL, PERTH).

Conservation status: CALM Conservation Code for Western Australian Flora: Priority Two. Known only from two populations in the vicinity of Pienic Lake, at one of which the species is locally dominant and consists of hundreds of plants. Threatened by human utilisation of the locality as a site for recreational purposes, some of which are destructive and environmentally insensitive.

Notes: From a short distance, *B. arcuata* appears to be leafless and superficially is reminiscent of *B. halophila*. However, it differs from *B. halophila* in having a few inconspicuous leaves, stipules, a different growth habit and branching pattern, terete or oval cladodes, and a different distribution. Allied to *B. peduncularis* from which it differs in being a much larger and almost leafless shrub, in having a different growth

habit and branching pattern, glabrous branches, leaves and calyces, larger flowers, and caducous bracteoles. As in the case of *B. pedunicularis*, the pedicel in *B. arcuata* is sometimes inserted some distance above the leaf axil.

Etymology: From the Latin *arcuatus*, curved like a bow; in reference to the curved nature of the young lateral growth.

16. *Bossiaea smithiorum* J.H.Ross, *sp. nov.*

B. barbarae J.H.Ross affinis, a qua bracteolis plerumque caducis cito, lamina oblonga ad obovata-oblonga anguste 3–7 (–10) mm longa, utroque costa declivi, margine leviter recurvo vel interdum involuto tantum ut lamina fere tereti, differt.

Type: Western Australia, Avon Distr., Wattengutten, 1 Aug.1993, *B.H. Smith 1652*; holo.: PERTH; iso.: CANB, MEL *2150434*.

Slender shrub to 2 m high and 1.5 m wide; young branchlets terete to oval in section and angled with a decurrent ridge below the point of attachment of each leaf, sparingly to densely clothed with appressed antrorse white hairs, sometimes with a thin white waxy outer layer that exfoliates, the abbreviated lateral shoots often slightly deflexed, terminating in a pungent point. Leaves alternate, unifoliolate; lamina oblong to narrowly obovate-oblong to almost terete, (1.5–) 3.0–7.0 (–10.0) mm long, 1–2 mm wide, arching down on either side of the midrib, the margins slightly recurved or sometimes revolute to such an extent that only the midrib is visible below or the revolute margins meeting and the lamina almost terete, apex obtuse or rounded, upper surface shiny, sparingly clothed with appressed hairs, glabrescent, lower surface paler than upper, sparingly to densely clothed with appressed hairs, with venation simple craspedodromous, the lateral veins often inserted almost at right angles to the midrib; petiole 0.4–0.8 mm long, sparingly to densely clothed with scattered hairs. Stipules subulate, 0.6–2.2 mm long, usually longer than the petiole, persistent. Flowers solitary or paired or sometimes pseudoracemose, the pedicels 3.5–7.0 mm long, glabrous throughout or with scattered appressed hairs in the lower portion and usually below the point of attachment of the bracteoles, rarely fairly densely pubescent throughout; bracts oblong or broadly ovate, 0.6–1 .0 mm long, brown, innermost largest, similar to the bracteoles, rounded or acute apically, sparingly to densely pubescent especially on margins and apically, usually caducous; bracteoles narrowly ovate, obovate or oblong, 0.7–1.5 mm long, scarious, margins ciliate, usually inserted at about the middle of the pedicel but sometimes in the lower third, invariably rapidly caducous and leaving two prominent raised opposite or more usually subopposite scars. Calyx glabrous externally except for hairs on the margin at the apex of the lobes, green suffused with dark red or purplish especially along the median line of the two upper lobes or dark red throughout; 2 upper lobes truncate, 0.7–1.5 mm long excluding the tube 2–2.6 mm long, with 3 lower lobes 1.0–1.5 mm long, acute, shorter than the tube. Standard 8.2–8.6 mm long including a claw 2.2–3.5 mm long, 8.2–8.7 mm wide, longer than the keel, orange-yellow internally with a deep red or purplish basal flare from which dark striations radiate into the lamina, externally red or purple basally with red or purple striations radiating towards the yellow margins; wings 6.8–7.4 mm long including a claw 2.7–3.2 mm long, 2.0–2.5 mm wide, externally yellow basally, red or purple apically; keel 4.8–5.5 mm long including a claw 2.7–3.0 mm long, 2.6–2.8 mm wide, externally yellow basally, red or purplish apically, densely woolly pubescent apically in the sinus. Stamen-filaments 4.2–6.0 mm long. Ovary 3.5–4.8 mm long, on a stipe 0.8–1.3 mm long, 3–6-ovulate, with scattered hairs along both sutures and upper portion of the valves. Pods 1.1–1.9 cm

long, 0.5–0.6 em wide, on a stipe usually exceeding the ealyx, mature valves glabrous or with seattered hairs on the sutures, pale tan brown or yellowish brown, ineonspieuously venose. Seeds 2.3–2.6 mm long, 1.3–1.6 mm wide, uniformly pale ereamy-yellow (Fig. 24).

Distribution and habitat: Oeeurs in the Avon and in the western portion of the Roe Botanieal Districts of the Southwestern Botanieal Provinee from Wattengutten SW of Manmanning in the north-west, southwards to south of Katanning and south-eastwards to Dragon Roeks (Fig. 21). Found in *Eucalyptus* woodland, often in deeomposed granitie soil around the base of large granite outerops in the 'run-off zone', or in gravelly lateritie soil or sand in speeies-rieh heath communities. Flowers July to Sept.

Representative specimens (30 examined): Dragon Rocks Reserve, 22 Aug.1972, *N.G. Marcham 72/580* (PERTH). Metchering Roek, 31 Aug.1985, *R.J. Cranfield 5289* (PERTH). Durokoppin Reserve, 19 Nov.1991, *B.H. Smith 1592* (MEL, PERTH). Uberin Rock, 19 km SW of Manmanning, 29 July 1992, *B.H. Smith 1600* (MEL, NSW, PERTH). 1.5 km E of Nyabing on Rd to Pingrup, 31 Oet.1996, *M.G. Corrick 11474* (MEL, NSW, PERTH).

Conservation status: Relatively widespread and not threatened at present.

Notes: *Bossiaea smithiorum* is a member of the group of spineseent speeies with sparingly to densely pubeseent young branehlets, glabrous ealyees, glabrous ovaries (apart from hairs on the sutures and oeeasional seattered hairs on the surfaee of the valves), and apieally woolly-pubeseent keel petals. *Bossiaea smithiorum* is the only speeies in this group in whieh the bracteoles are usually rapidly eadueous leaving two prominent raised opposite or subopposite sears on the pedieel, and it is distinguished further by the distinetive leaves with the lamina oblong to narrowly obovate-oblong, 3–7 (–10) mm long, arehing down on either side of the midrib with the margins slightly recurved or sometimes revolute to sueh an extent that the lamina is almost terete. Even when the leaves are more or less glabrous in *B. smithiorum*, the young branehlets are pubeseent. *Bossiaea smithiorum* differs from *B. barbarae* in leaf shape, in having rapidly eadueous bracteoles, and in having different eeologieal preferenees. *Bossiaea barbarae* favours the perimeter of salt lakes.

Smith 1933 (MEL, PERTH) from Holleton is atypieal in having almost glabrous young branehlets.

Etymology: The speeies is named in honour of Basil and Mary Smith of Manmanning who have eontributed mueh to this study of the Western Australian speeies of *Bossiaea*, and have assisted many others in advaneing knowledge of the Western Australian flora.

17. *Bossiaea barbarae* J.H.Ross, *sp. nov.*

B. smithiorum J.H.Ross affinis, a qua braeteolis persistentibus, lamina obovata vel leviter obtrullata vel obovata-oblonga vel elliptiea vel ovali 1.2–3.9 mm longa plerumque plana ad v-formata leviter in seetione, margine non reeurvo vel reeurvus leviter, differt.

Type: Western Australia: Roe Distr., Salmon Gums Nature Reserve, Sunrise Hill Rd, 16 km NE of Salmon Gums P.O., 15 Aug.1998, *B. Archer 1090*; holo.: PERTH; iso.: CANB, K, MEL *2150159*, NSW.

Figure 23. *Bossiaea arcuata* – a, flowering twig, × 1; b, calyx opened out (upper lobes on right) and pedicel showing the raised scars that mark the points of attachment of the caducous bracteoles , × 4; c, standard, × 4; d, wing petal, ×4; e, keel petal, × 4; f, gynoecium, × 4; g, margin of ovary showing scattered hairs along the lower suture, × 20; h, seed, hilar view, × 8; i, seed, lateral view, × 8. a-i from *B. Archer 1560.*

Figure 24. *Bossiaea smithiorum* – a, flowering twig, × 1; b, cross section of leaf showing margins inrolled on lower surface, × 20; c, calyx opened out (upper lobes on right) and pedicel showing the prominent raised scars that mark the points of attachment of the caducous bracteoles; d, standard, × 4; e, wing petal, × 4; f, keel petal, × 4; g, gynoecium, × 4; h, fruiting twig, × 1; i, seed, hilar view, × 12; j, seed, lateral view, × 12. a–g from *Smith 1652*; h–j from *Ross 3826*.

Spreading compact spinescent glaucous shrub up to 0.75 m high and 1.5 m wide; young branchlets terete to oval in section and slightly angled with a decurrent ridge below the point of attachment of each leaf, but not flattened, sparingly to densely clothed with straight appressed antrorse or crinkled slightly spreading hairs, sometimes with a white scurfy outer layer that exfoliates, the abbreviated lateral shoots often slightly deflexed, terminating in a reddish-brown pungent point. Leaves alternate or fascicled, unifoliolate; lamina obovate or slightly obtrullate, obovate-oblong, elliptic or oval, 1.2–3.9 mm long, 0.9–2 mm wide, usually flat to slightly v-shaped in section, with margins not or slightly recurved, apex rounded or often depressed-retuse, sparingly to densely clothed on both surfaces with appressed straight or crinkled slightly spreading hairs, glabrescent especially on the upper surface, rarely glabrous throughout, thick, coriaceous, with venation usually indistinct apart from the prominent slightly raised midrib 0.1–0.2 mm wide on the lower surface but simple craspedodromous; petiole 0.3–0.7 mm long, sparingly to densely clothed with scattered hairs. Stipules subulate, 0.6–2 mm long, usually longer than the petiole, glabrous or almost so, reddish-brown when young, persistent. Flowers solitary or paired, the pedicels 3–6 mm long, glabrous or with occasional scattered hairs especially basally; the outer bract ovate, the innermost largest, similar to the bracteoles, 0.5–1.2 mm long, inconspicuously longitudinally striate, with scattered hairs along the midline especially apically and marginal cilia, persistent; bracteoles narrowly elliptic to obovate, oblong or ovate, 0.9–1.5 mm long, 0.4–0.5 mm wide, scarious or not, usually inserted towards the middle or in the lower half of the pedicel, margins ciliate especially apically, persistent. Calyx glabrous externally except for hairs on the margins of the lobes, green suffused with red or burgundy especially on the upper surface or red or burgundy throughout except for green on the lower surface near the base; 2 upper lobes truncate, 0.8–1.4 mm long excluding the tube 1.5–3.0 mm long, with 3 lower lobes 0.6–1.2 mm long, acute, shorter than the tube. Standard 7.0–9.3 mm long including a claw 1.5–3.3 mm long, 6.8–9.4 mm wide, longer than the keel, deep yellow internally with a bright red basal horseshoe-shaped flare around a paler greenish-yellow throat, externally yellow basally surrounded by a bright red zone from which red striations radiate into the yellow margins; wings 5.8–7.2 mm long including a claw 2.3–3.3 mm long, 1.7–2.5 mm wide, externally red; keel 5.1–5.8 mm long including a claw 2.3–2.9 mm long, 2.1–2.7 mm wide, externally red, densely woolly pubescent apically in the sinus. Stamen-filaments 3.8–5.9 mm long. Ovary 3.0–4.2 mm long, on a stipe 0.5–1 mm long, 4–8-ovulate, with scattered hairs along both sutures and sometimes on the surface of the valves apically. Pods 0.8–1.6 cm long, 0.45–0.65 cm wide, usually on a stipe about as long as or exceeding the calyx, with mature valves pale tan- or pinkish-brown, inconspicuously venose, with scattered hairs on the sutures and occasional scattered hairs throughout but especially towards the apex. Seeds 1.8–2.3 mm long, 1.3–1.5 mm wide, uniformly pale creamy-yellow (Figs 9d, 25).

Distribution and habitat: Occurs chiefly in the Roe Botanical District from west of Hyden in the north-west southwards to Lake Pallerup and eastwards to about 30 km NNE of Mt Heywood, with a northern outlier in the western portion of the Coolgardie Botanical District at Lake Koorkoordine north of Southern Cross (Fig. 21). Recorded from coarse sand over clay loam, creamy-brown clay loam, grey clay, shallow white sand over a greyish clay and fine sandy loam. Usually found on the perimeter of salt lakes above the samphire zone. Often associated with *Melaleuca* spp. Flowers Aug.–Oct.

Figure 25. *Bossiaea barbarae* – a, flowering twig, ×1; b, upper surface of leaf-lamina showing slight v-shape and depressed-retuse apex, × 20; c, calyx opened out (upper lobes on right), × 4; d, standard, × 4; e, wing petal, × 4; e, keel petal, × 4; g, gynoecium, × 4; h, margin of ovary enlarged showing scattered hairs along sutures, × 20; i, fruiting twig,×1; j, seed, hilar view, × 12; k, seed, lateral view, × 12. a–h from *B. Archer 1083*; i–k from *B. Archer 855*.

Representative specimens (30 examined): Frank Hann National Park, 7 Aug.1978, *D. Monk 318* (PERTH); 17 km NE of Scaddan on Truslove Rd, 9 Sept.1983, *P. van der Moezel 277* (PERTH); Lake Halbert, 8 km E of Mt Ridley, 12 Oct.1991, *W.R. Archer 1210912* (MEL, PERTH); Fuller Rd, 35.8 km NW of Salmon Gums P.O., 4 Oct.1997, *B. Archer 768* (MEL, PERTH); Lake Pallerup, 22.5 km SE of Lake King Goods Shed, 13 Oct.1997, *B. Archer 836* (MEL, PERTH); Ridley Rd, 12 km E of Grass Patch, 8 Nov.1997, *B. Archer 854* (MEL, PERTH).

Conservation status: Relatively widespread and not threatened at present.

Notes: *Bossiaea barbarae* is a member of the group of spinescent species with sparingly to densely pubescent young branchlets, glabrous calyces, glabrous ovaries (apart from hairs on the sutures and occasional scattered hairs on the surface of the valves), and apically woolly-pubescent keel petals. *Bossiaea barbarae* is distinguished from the other species by its small (1.2–3.9 mm long) thick glaucous leaves with the lamina flat or slightly v-shaped in section, the margins not or scarcely recurved, the apex rounded or often depressed-retuse, the midrib prominent on the lower surface, slightly raised and 0.1–0.2 mm wide, and the upper and lower surfaces typically sparingly to densely clothed with straight appressed hairs or crinkled somewhat spreading hairs.

The degree of development of the indumentum on the young leaves varies and to some extent appears to be correlated with distribution. The lamina is typically sparingly to densely clothed with straight appressed or crinkled somewhat spreading hairs but occasionally the hairs are very tightly coiled (E of Hyden and W of Lake King in the north-west) or the lamina is almost glabrous throughout (Mt Heywood in the east). These extreme expressions are considered no more than part of the overall variation within the species. Even when the leaves are more or less glabrous, the young growth of the current season is still sparingly to densely clothed with appressed hairs which, together with the distinctive small leaves, distinguishes *B. barbarae* from the spinescent species with glabrous new growth such as *B. spinescens* and *B. concinna*.

Shrubs are usually greyish-green in appearance, except for the light green flush of new growth. Plants are compact when growing in the open but lax when growing in the shade beneath *Melaleuca* spp.

Material from Lake Koorkoordine, *Newby 8414* (PERTH); *Ross 4062, 4063 & Archer* (MEL, PERTH) has a slightly different facies, is slightly atypical, apparently separated from other populations by a large discontinuity, and is included in this species with some hesitation. *Ross 4062, 4063 & Archer* are unusual in that the branchlets are almost glabrous apart from the youngest growth of the current season, and in having occasional scattered hairs on the pedicels and calyces. Leaf shape distinguishes these specimens from *B. aurantiaca* and *B. calcicola*, the other spinescent species with sparingly pubescent calyces and pedicels.

Etymology: The species is named in honour of Barbara Archer of Norseman who has contributed greatly to this study of the Western Australian species of *Bossiaea,* and assisted many others in advancing knowledge of the Western Australian flora.

18. *Bossiaea preissii* Meisn. in J.G.C.Lehmann, *Pl. Preiss.* 1: 82 (1844). *Type*: 'In glareosis sterilibus inter frutices promontorii Cape Riche, d, 20 Nov.1840. specimina pauca, manca. Herb. Preiss. 986'; lecto.: NY (here selected); isolecto.: LD.

Bossiaea rigida Turcz., *Bull. Soc. Imp. Nat. Moscou* 26: 285 (1853). *Type*: 'Drum. V. n. 79.', 1849, *J. Drummond, 5th collection, no. 79*; lecto.: KW (here selected); isolecto.: K, MEL *664727*, PERTH.

Bossiaea concinna Benth., Fl. Austral. 2:161 (1864) pro parte quoad speeim. Maxwell, K, MEL *664780.*

Compaet shrub to 1.4 m high and 1.3 m wide, almost eompletely glabrous, branehlets terete, angled or slightly flattened towards the extremities, with a deeurrent ridge below the point of attaehment of eaeh leaf, the abbreviated lateral shoots usually terminating in a pungent point. Leaves alternate, unifoliolate; lamina obovate, obovate-oblong or elliptie, (3.5) 5.0–9.0 (10.8) mm long, 2.0–3.5 (4.5) mm wide, rounded or obtuse apieally, often glaueous, eoriaceous, with margins not reeurved, glabrous, with venation prominent or obseure, simple eraspedodromous, midrib usually eonspieuous on the lower surfaee and 0.2–0.3 mm wide; petiole 0.5–1.2 mm long. Stipules 0.3–0.65 mm long, usually shorter than the petiole, narrowly triangular or subulate, persistent. Flowers solitary, pendulous, the pedieels mostly up to 5 mm long, rarely to 10 mm, glabrous; braet solitary or braets few, when few the outer basal braets ovate, up to 0.7 mm long, not imbrieate, with marginal eilia and sometimes seattered hairs along the midline, the uppermost braet larger and similar to the braeteoles, oblong or obovate-oblong, 0.7–2.1 mm long, glabrous apart from eiliate margins especially apieally, appressed to or elasping the pedieel, persisting until the young pods develop; braeteoles oblong or obovate-oblong, 1.0–2.8 mm long, inserted slightly below or above the middle of the pedieel, not overlapping the base of the ealyx, longitudinally striate, glabrous apart from marginal eilia, persisting at least until the young pods develop. Calyx green or suffused with purple, glabrous externally exeept for hairs on the margins of the lobes; 2 upper lobes mueh broader than the lower three, (1.2–) 1.5–2.0 mm long exeluding the tube (3.5–) 4.1–5.5 mm long, rounded or obtuse, the apiees diverging, aeute, with 3 lower lobes 1.0–2.1 mm long, (0.9–) 1.2–1.5 mm wide, aeute, shorter than the tube. Standard usually longer than wide, (9.5–) 13.0–17.4 mm long ineluding a elaw (2.5–) 3.5–5.0 mm long, (9.4–) 11.0–16.0 mm wide, usually slightly shorter than the keel, internally red or yellow, orange or apricot suffused with red and with a red or orange horseshoe-shaped flare around a basal yellowish throat, sometimes the margin distinctly yellow or orange-yellow, externally red, yellow with pale pinkish-red striations radiating from the base, orange-red or aprieot and with red striations; wings (9.0–) 11.0–18.2 mm long ineluding a elaw (3.5–) 4.0–6.1 mm long, aurieled, (2.6) 3.0–4.5 mm wide, externally red, orange-red, aprieot or yellow apieally, pinkish-red or yellow basally; keel (9.0–) 12.2–18.2 mm long ineluding a elaw (3.5) 4.5–7.2 mm long, aurieled, (2.5) 3.5–5.0 mm wide, externally pinkish apieally or oeeasionally yellow, densely pubeseent or woolly apieally in the sinus. Stamen-filaments (8.4–) 9.5–17.5 mm long. Ovary 5.5–9.5 mm long, on a stipe 2.0–6.3 mm long, 8–15-ovulate, glabrous throughout or with seattered hairs along the lower suture towards the apex and sometimes with seattered hairs on the valves apieally. Pods oblong, 1.4–2.9 em long, 0.6–0.7 em wide, on a stipe just exeeeding the ealyx, with valves ineonspieuously venose, margins slightly thiekened, glabrous or almost so. Seeds 2.3–2.6 mm long, 1.4–1.8 mm wide, olive to yellowish-brown with purplish mottles (Figs 10, 26).

Distribution and habitat: Oeeurs in the eastern portion of the Menzies subdistriet of the Darling Botaniеal Distriet, the Eyre and western portion of the Roe Botaniеal Distriets of the Southwestern Botaniеal Provinee from near Pingrup in the north, Tenterden in the west, eastwards to Israelite Bay (Fig. 21). Oeeurs in sand and on dunes along the eoast in low shrub, *Banksia* or mallee heathland, and away from the eoast in sand, loam, gravel and rocky situations or low-lying areas subjeet to waterlogging in shrubland or heathland. Flowers May–Oet.

Figure 26. *Bossiaea preissii* – a, flowering twig, × 1; b, lower surface of leaf showing prominent midrib and inconspicuous venation, × 5; c, calyx opened out (upper lobes on right) and pedicel showing the upper basal bract similar in size and shape to the paired bracteoles, × 4; d, standard, × 4; e, wing petal, × 4; f, keel petal, × 4; g, fruiting twig, × 1; h, seed, hilar view, × 10; i, seed, lateral view, × 10. a–f from *B. Archer 328B*; g–i from *W. Archer 2210958*.

Representative specimens (107 examined): 9 km SW of Pingrup on Rd to Borden, 8 May1969, *P.G. Wilson 8290* (PERTH). Boat Harbour, 100 km due E of Albany, 14 Aug.1970, *N.G. Marchant 70/137* (PERTH). Dillon Bay, 4 Oct.1981, *M.G. Corrick 7714* (MEL). 31 km from Mt Ragged towards Esperance, 9 Sept.1983, *J. Taylor 1590* & *P. Ollerenshaw* (CANB, MEL, PERTH). Thomas R. mouth, Cape Arid, 13 June 1985, *G.J. Keighery 7775* (PERTH). 5 km E of Condingup, 26 May1996, *B. Archer 328B* (MEL).

Conservation status: Not threatened at present.

Notes: *Bossiaea preissii* is distinguished readily from the other spinescent species by having pendulous flowers in which the keel petals are about the same length as the standard. In addition, the colour of the flowers in *B. preissii* is different.

Flower colour may vary considerably from plant to plant within a single population. This is well illustrated by a suite of specimens in MEL from near Condingup (*B. Archer 328, 328A, 328B, 360, 361, 362, 363, 368, 368A*). In addition to this variation in flower colour, the size of the flowers is also variable and occasional plants within a population, for example *B. Archer 328*, have smaller flowers than usual. Flower size is less variable than flower colour. These differences in flower colour and size do not appear to be taxonomically significant. The Maxwell syntype of *B. concinna* Benth. from between M'Callum and Stokes Inlets is a small-flowered specimen of *B. preissii*.

Typification: As indicated by Meisner, the *Preiss* material upon which he based his description of *B. preissii* is very poor. Indeed, Meisner deserves credit for assigning it to the correct genus! I here select the specimen of *Preiss 986* in NY, which formed part of Meisner's own herbarium, as the lectotype of *B. preissii*. The specimen consists of a twig about 8 cm long on which the remains of a solitary flower are visible. The specimen of *Preiss 986* in LD is larger (13.5 cm long) but sterile.

19. *Bossiaea spinescens* Meisn. in J.G.C.Lehmann, *Pl. Preiss.* 1: 82 (1844)
Bossiaea rufa R. Br. var. *foliosa* Benth., *Fl. Austral.* 2 : 166 (1864).

Type: 'In limoso-lapidosis sterilibus summitatis montis Blakewell (York) d. 11. Sept.1839, Herb. Preiss 1031..'; syn.: LD, MEL *664707*, NY; 'et in glareosis sylvae inter praedia rustica Dom. Barker et Lennard (York)'d. 12.Apr.1840, No. [Preiss] 1030'; syn.: LD; '(Drummond 259 et coll. 1.)'; syn.: K, MEL *664704*.

Bossiaea pancifolia sensu Lindley, *Edwards's Bot. Reg.* 29: t.63 (1843), non Benth. (1841).

Slender spreading or compact spinescent shrub to 2 m high and 1.5 m wide; young branchlets oval in section to flattened and narrowly winged, usually with a conspicuous decurrent ridge below the point of attachment of each leaf, glabrous or with few scattered hairs especially when very young, with a tuft of hairs at the base of each bud in the leaf axil, the abbreviated lateral shoots often slightly deflexed, terminating in a pungent point. Leaves alternate or appearing fascicled, unifoliolate; the petiole typically attached almost at right angles to the lamina and the lamina held in a slightly different plane to the petiole, lamina oblong, obovate-oblong, obovate or oval, 2–10 mm long, 1.0–4.2 (5.5) mm wide, rounded, obtuse, truncate or emarginate apically, concolorous, with margins not recurved, upper surface glabrous, lower surface glabrous or with occasional scattered hairs along the midrib, with venation visible in young leaves but often obscure in older leaves, simple craspedodromous, the lateral veins usually inserted at an angle of about 45° to the midrib; petiole 0.6–1.5 mm long, glabrous or with occasional scattered hairs. Stipules subulate to narrow-ovate, 0.5–1.7 mm long, usually shorter than the petiole, scarious, glabrous or with scattered hairs especially towards the

apex, persistent. Flowers solitary or pseudoracemose, the pedicels 0.25–1.2 cm long, green, glabrous or almost so; bracts not imbricate, innermost narrowly ovate or oblong, 0.5–0.9 mm long, 0.1–0.3 mm wide, with scattered hairs especially on margins and apically and sometimes along the midline, brown, caducous or sometimes persisting; bracteoles oblong or obovate-oblong, 1.0–1.7 mm long, usually attached towards the apex of the pedicel and sometimes overlapping the base of the calyx but occasionally inserted near the base, glabrous apart from cilia towards the apex, invariably persisting. Calyx glabrous externally except for hairs on the margins at the apex of the lobes, green but the two upper lobes suffused with red or suffused with deep red throughout; 2 upper lobes truncate, 0.8–1.4 mm long excluding the tube 2.0–3.5 mm long, 3 lower lobes 0.6–1.3 mm long, acute, shorter than the tube. Standard 8–10 mm long including a claw 3.0–4.2 mm long, 8.0–11.5 mm wide, longer than the keel, orange-yellow internally with a deep red or reddish-brown basal horseshoe-shaped flare from which red striations radiate into the lamina, externally red with an orange-yellow margin; wings 6.5–7.7 mm long including a claw 2–3.5 mm long, 1.9–2.5 mm wide, dark red; keel 5.2–7.0 mm long including a claw 2.4–3.4 mm long, 2.5–3.4 mm wide, dark red, densely woolly pubescent apically and in the sinus. Stamen-filaments 4.7–6.2 mm long. Ovary 3.5–5.2 mm long, on a stipe c. 1 mm long, 6-ovulate, glabrous apart from scattered hairs on the lower suture. Pods 1.4–2.7 cm long, 0.4–0.7 cm wide, on a stipe that just exceeds the calyx, mature valves glabrous or with occasional scattered hairs on the lower suture, brown, inconspicuously venose. Seeds 2.4–3.9 mm long, 1.6–2.2 mm wide, uniformly pale creamy-brown (Fig. 27).

Distribution and habitat: Occurs in the Irwin, Avon and Darling (Dale subdistrict) Botanical Districts of the Southwestern Botanical Province from Port Gregory in the north, south-eastwards to the vicinity of Wagin (Fig. 28). Found in *Eucalyptus* woodland and in heathland, often on laterite or amongst granite boulders but also recorded growing on sand or loam. Flowers July–October.

Representative specimens (50 examined): 10 miles [16 km] W of Mogumber Mission, 25 July 1964, *A.S. George 6357* (PERTH). Corner of Callingri Rd and Great Northern Hwy, 14 Oct.1984, *M.G. Corrick 9286* (MEL, PERTH). Willis Rd, 10 km NE of Yandanooka, 1 Aug.1993, *A. Carr 209* (PERTH). Dryandra Forest, Patonga Rd, 3 km S of its junction with Tomingley Rd, 30 Oct.1996, *M.G. Corrick 11468* (MEL). Wongamine Nature Reserve, Forrest Rd, 200 m N of Toodyay–Goomalling Rd, 21 Nov.1996, *J.H. Ross 3821* (MEL, PERTH). Mt Hardy Nature Reserve, 11 km SE of York on York–Quairading Rd, 25 Nov.1996, *J.H. Ross 3850* (MEL, PERTH).

Conservation status: Not threatened currently.

Notes: *Bossiaea spinescens* is a member of the group of essentially glabrous spinescent species with the young branchlets glabrous or with few scattered hairs, glabrous calyces and apically woolly-pubescent keel petals. It is differentiated from the other species in this group by the oval to flattened and winged young branchlets, and the relatively thin-textured leaves in which the petiole is typically attached almost at right angles to the lamina (so that the lamina is held in a slightly different plane to the petiole).

The bracteoles in *B. spinescens* usually persist, but sometimes they are caducous.

Bossiaea calcicola is superficially similar to *B. spinescens* but differs in having sparingly to densely appressed-pubescent young branchlets, leaves, pedicels and calyces, the petiole not attached almost at right angles to the lamina, and it occurs in maritime situations where it is associated with limestone or compacted sand derived from limestone. The two species do not grow together.

Figure 27. *Bossiaea spinescens* – a, flowering twig, × 1; b, node showing an abbreviated spinescent lateral shoot and an abaxial view of two leaves to illustrate the attachment of the petiole to the lamina and the characteristic articulated joint so that the lamina is held in a slightly different plane to the petiole, × 6; c, calyx opened out (upper lobes on right), × 4; d, standard, × 4; e, wing petal, × 4; f, keel petal, ×4; g, fruiting twig, × 1; h, seed, hilar view, × 8; seed, lateral view, × 8. a–f from *Corrick 11465*; g–i from *Ross 3822*.

Smith 1919 (MEL, PERTH) found growing on red sand 10 km N of the Emu Fence, Karroun reserve, is referred tentatively to *B. spinescens*. It is atypical in that the young branchlets are sparingly pubescent and not distinctly winged, the upper and lower surfaces of some leaves are sparsely appressed pubescent, and the pedicels and calyces have occasional scattered hairs. In being sparingly pubescent, *Smith 1919* shows an approach to *B. calcicola* which occurs on the coastal limestone plain N of Port Gregory and on some of the off-shore islands, but it occupies a quite different habitat to *B. calcicola* and has leaves of a different texture and colour. *Hislop & Orsini MH316* (PERTH) from ca 38 km NE of Dalwallinu is reminiscent of *Smith 1919* in lacking distinctly winged young branchlets and in having sparingly pubescent young branchlets and scattered hairs on the lower surfaces of some leaves. It too is hesitantly referred to *B. spinescens*.

20. *Bossiaea calcicola* J.H.Ross, *sp. nov.*

B. spinescentiae Meisn. affinis, a qua ramulis juvenibus et foliis et pedicellis et calycibus parce versus dense adpresse-pubescentibus, petiolo neque ad superficiem abaxialem folioli fere affixo, differt.

Type: Western Australia, Irwin Distr., Kalbarri National Park, Eagle Gorge, 7 km S of Kalbarri, 12 Aug.1989, *D. & B. Bellairs 1425*; holo.: PERTH.

Compact glaucous spinescent shrub to 70 cm high, young branchlets oval in section to flattened, usually with a prominent decurrent ridge below the point of attachment of each leaf, sparingly to densely clothed with appressed hairs (young shoots densely villous), sometimes with a white waxy outer layer that exfoliates, the abbreviated lateral shoots terminating in a pungent point. Leaves alternate or appearing fascicled, unifoliolate; lamina oblong, rotund, obovate-oblong or cuneate, 1.5–7.0 mm long, 1.1–4.0 mm wide, rounded, obtuse, emarginate or truncate apically, with margins not recurved, upper surface sparingly to densely clothed with short hairs, glabrescent, lower surface sparingly to densely clothed with short hairs, glabrescent, with venation visible in young leaves but often obscure in older leaves, simple craspedodromous, the lateral veins usually inserted at an angle of about 45° or almost at right angles to the midrib; petiole 0.6–1.2 mm long, sparingly to densely pubescent. Stipules subulate, 0.7–1.7 mm long, shorter or longer than the petiole, with marginal cilia or scattered hairs towards the base, persistent. Flowers solitary or sometimes pseudoracemose, the pedicels 4.5–7.2 mm long, green or suffused with red, sparingly to densely clothed with appressed to slightly spreading hairs; bract often solitary, ovate or oblong, 0.6–1.2 mm long, with scattered hairs especially apically, brown, caducous or sometimes persisting; bracteole oblong or obovate-oblong, 0.5–1.4 mm long, usually attached towards the apex of the pedicel and sometimes just overlapping the base of the calyx, with scattered hairs especially on the margins, along the midline and apically, usually persisting but sometimes caducous. Calyx sparingly to densely clothed with appressed hairs externally, green and suffused with red especially on the upper lobes or red throughout; 2 upper lobes truncate or rounded, the lobes diverging, 0.9–1.3 mm long excluding the tube 1.7–2.9 mm long, with 3 lower lobes 0.7–1.2 mm long, acute, shorter than the tube. Standard 7.4–8.2 mm long including a claw 2.3–3.1 mm long, 7.8–9.5 mm wide, longer than the keel, internally bright yellow with a red or pinkish-red basal horseshoe-shaped flare around two greenish-yellow 'eyes' in the throat, externally the two basal 'eyes' surrounded by a red zone from which longitudinal red striations radiate into the lamina, only the lateral margins yellow; wings 5.9–7.0 mm long including a claw 2.3–3.0 mm long, 1.8–2.5 mm wide, externally pinkish-red; keel 5.2–5.8 mm long including a claw

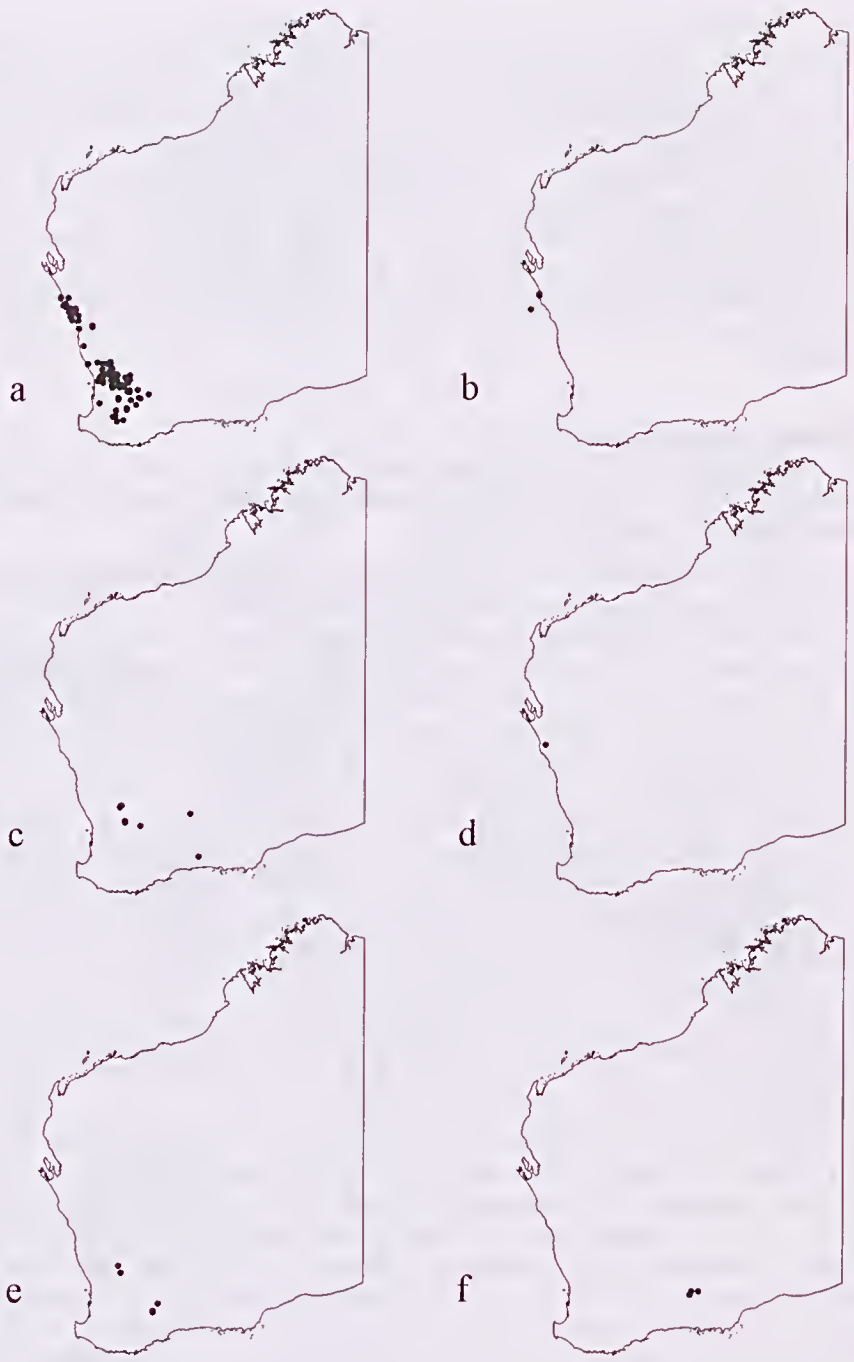

Figure 28. Distribution of a, *Bossiaea spinescens*; b, *B. calcicola*; c, *B. concinna;* d, *B. inundata*; e, *B. atrata*; f, *B. aurantiaca*.

2.3–2.6 mm long, 2.0–2.2 mm wide, externally pinkish-red, darker apically, densely woolly pubescent apically and in the sinus. Stamen-filaments 4.2–5.5 mm long. Ovary 3.2–4.3 mm long, on a stipe 0.6–0.9 mm long, 4–6-ovulate, glabrous apart from scattered hairs on the lower suture especially apically and sometimes with occasional scattered hairs on the valves. Pods 1.2–2.2 cm long, 0.5–0.8 cm wide, on a stipe about as long as or just exceeding the calyx, mature valves glabrous or with occasional scattered hairs on the lower suture and sometimes on the valves, brown, inconspicuously venose. Seed (only one mature seed seen) elliptic, 3.5 mm long, 2.2 mm wide, chestnut-brown (Fig. 29).

Distribution and habitat: Occurs in the southern portion of the Carnarvon and northern portion of the Irwin Botanical Districts from Dirk Hartog Island in the north to the Hutt River lagoon in the south (Fig. 28). Favours low open heath in maritime situations and associated with limestone or compacted sand derived from limestone. Does not occur on loose sand on the coastal dunes. Found in exposed situations along coastal cliffs and sea-facing slopes. Flowers July–Sept.

Representative specimens (15 examined): East Wallabi Is, undated, *G.M. Storr s.n.* (PERTH *2741180*). N side of Passage Paddock, Dirk Hartog Is, 2 Sept.1972, *A.S. George 11377* (PERTH). Hutt Lagoon, 30 Aug.1983, *R.J. Cranfield 4004* (PERTH). Shark Bay, False entrance, 24 July1988, *P. Morat 8332* (PERTH). Kalbarri National Park, Natural Bridge Lookout, 22 July1998, *D. & B. Bellairs* 5005 (PERTH). East Wallabi Is, Flag Hill, 30 Aug. 1998, *A.S. George 17430* (MEL, PERTH).

Conservation status: CALM Conservation Code for Western Australia: Priority Four.

Notes: The maritime habitats occupied by *B. calcicola* tend to be harsh and windswept where the plants grow either in open exposed situations or sheltered in amongst other shrubs. The prevailing salt-bearing winds prune the plants and kill many of the apical shoots so that many plants exhibit 'die-back'.

Superficially similar to *B. spinescens* but differs in having sparingly to densely appressed-pubescent young stems, leaves, pedicels and calyces, thick leaves, the petiole not attached almost at right angles to the leaf-lamina, and quite different ecological preferences.

Bossiaea calcicola is poorly represented in herbaria and its range of distribution not adequately known. Further field work between Port Gregory and Kalbarri where its distribution overlaps with that of *B. spinescens* would be beneficial. If it was not for the indumentum on the young stems, leaves, pedicels and calyces, and the different ecological preferences, *B. calcicola* could possibly be accommodated in a broader concept of *B. spinescens*.

Etymology: From the Latin *calcarius*, limestone, and *cola*, dweller; in reference to the preferred habitat of this species on limestone or sands derived from limestone.

21. *Bossiaea concinna* Benth., *Fl. Austral.* 2: 161 (1864).

Type: '*Drummond, 5th coll. n.* 81, *and Suppl. n.* 41 (very spinescent specimen with dark-coloured flowers); Grass-tree plains between M'Callum and Stokes Inlets, *Maxwell* (more leafy and less spinescent, with apparently bright yellow flowers)': *J. Drummond Suppl. n. 41*; lecto.: K (here selected); isolecto.: MEL *651105*.

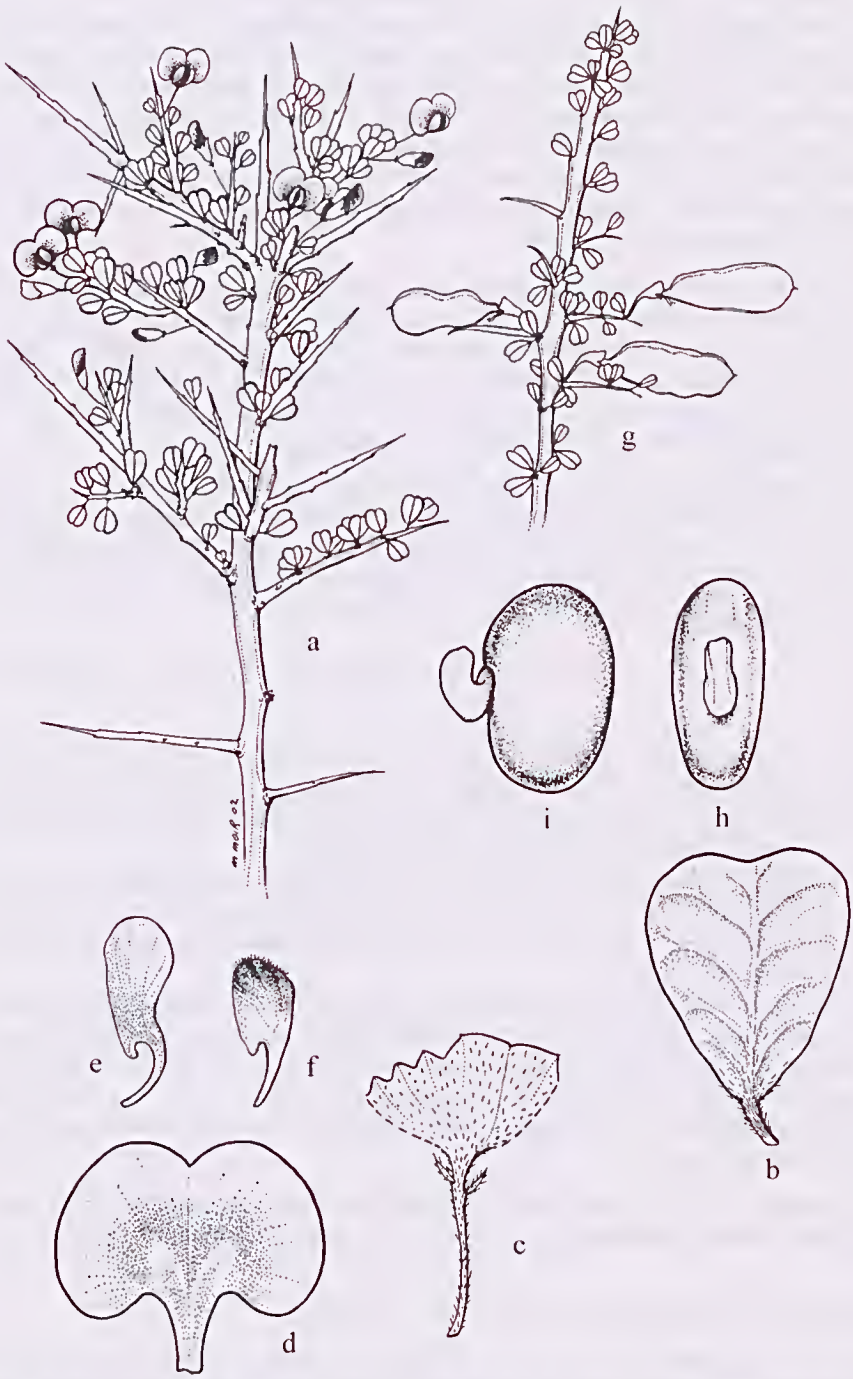

Figure 29. *Bossiaea calcicola* – a, flowering twig, ×1; b, leaf, lower surface, × 8; e, calyx opened out (upper lobes on right) and showing persistent braeteoles near the apex of the pedicel , × 4; d, standard, × 4; e, wing petal, × 4; f, keel petal, × 4; g, fruiting twig, × 1; h, seed, hilar view, × 10; i, seed, lateral view, × 10. a–f from *Bellairs 1425*; g from *Ross 4095*; h and i from *Markey 1556*.

Compact dense intricately branched spinescent shrub to 1.5 m high and 2 m wide; young branchlets terete to oval in section and angled with a conspicuous raised decurrent ridge below the point of attachment of each leaf but not winged, glabrous or with occasional scattered hairs especially when young, the hairs on the apices of axillary bracts often appearing as a tuft of hairs in the leaf axils, the abbreviated lateral shoots terminating in a pungent point. Leaves alternate or apparently fascicled, unifoliolate; lamina oblong or narrowly obovate-oblong, 1.8–6.5 mm long, 1.0–1.3 (–1.6) mm wide, usually held erect, upper surface typically convex in section, the lamina sloping towards the margins on either side of the midrib but sometimes almost concave, the lamina arching upwards towards the apex or apex recurved, rounded apically, glaucous in mature leaves, glabrous throughout or with a few hairs on the lower surface near the apex, with venation indistinct but simple craspedodromous; petiole 0.4–0.8 mm long, glabrous. Stipules narrowly ovate, 0.5–0.9 mm long, longer or shorter than the petiole, glabrous, persistent. Flowers solitary or pseudoracemose, the pedicels 3.5–11.0 mm long, usually longer than the leaves, green or suffused with red, glabrous; solitary basal bract oblong, 0.6–1.3 mm long, scarious, with few apical cilia only or with marginal and apical cilia, inconspicuously longitudinally striate, caducous; bracteoles oblong, 0.9–1.5 mm long, usually attached in upper half of pedicel and apices often overlapping the base of the calyx, scarious, ciliate apically, caducous or persistent. Calyx glabrous externally except for marginal hairs at the apex of the lobes, green, the upper surface suffused with pinkish-red, the lower surface green apart from red tips to the lobes; 2 upper lobes truncate, 0.8–1.8 mm long excluding the tube 2.0–3.5 mm long, with 3 lower lobes 0.6–1.2 mm long, acute, shorter than the tube. Standard 8.0–9.2 mm long including a claw 2.7–4.0 mm long, 7.0–9.0 mm wide, bright yellow internally with a basal pinkish-red horseshoe-shaped flare around two paler yellow 'eyes' in the throat, externally the two basal yellow 'eyes' prominent and with yellow or dark reddish striations radiating into the surrounding dark reddish or pinkish-red zone, the lateral margins yellow; wings 5.8–7.4 mm long including a claw 2.9–3.6 mm long, 1.4–1.7 mm wide, externally red or pinkish-red apically; keel 5.4–5.8 mm long including a claw 2.5–3.3 mm long, 1.9–2.4 mm wide, dark pinkish-red apically, densely woolly pubescent apically in the sinus. Stamen-filaments 4.4–5.7 mm long. Ovary 2.9–5.0 mm long, on a stipe 0.3–1.4 mm long, 6–8-ovulate, glabrous throughout or with scattered hairs on the lower suture towards the apex. Pods 1.0–1.6 cm long, 4.8–5.2 mm wide, on a stipe that exceeds the calyx, with valves pale pinkish- or chestnut-brown, inconspicuously or scarcely transversely venose, glabrous. Seeds 2.4–2.6 mm long, 1.4-1.8 mm wide, uniformly pale creamy or yellowish-brown (Figs 9e, 30).

Distribution and habitat: Occurs in the Avon and Coolgardie Botanical Districts. Known from two disjunct locations (but see under Notes), one just east of Cunderdin and the other south of Woolgangie, SW of Coolgardie (Fig. 28). Favours light-coloured or red-brown sand over clay-loam above the samphire zone around the perimeter of salt lakes. Usually found near and often within sight of a salt lake system. Flowers Sept.–Oct.

Representative specimens (15 examined): 103 miles (164.8 km) Great Eastern Highway (interpreted as 9 km E of Cunderdin), 5 Sept.1966, *E.M. Bennett 633* (PERTH); 31 km WSW of Queen Victoria Rock, 25 Sept.1979, *K. Newby 6095* (PERTH); 13.5 km S. of Woolgangie, 22 Sept.1993, *G.J. Keighery 12971* (PERTH); 10 km S of Woolgangie, 20 Oct. 2001, *B. Archer 2031* (MEL); Wyola North rd, 11.2 km E of Cunderdin, 2 Oct. 2002, *B. Archer 2247* (MEL, PERTH).

Figure 30. *Bossiaea concinna* – a, flowering twig, × 1; b, cross section of leaf lamina showing the typical slightly convex upper surface, × 20; c, calyx opened out (upper lobes on right), × 4; d, standard, × 4; e, wing petal, × 4; f, keel petal, × 4; g, fruiting twig, × 1; h, seed, hilar view, × 8; i, seed, lateral view, × 8. a–f from *B. Archer* 1168; g from *B. Archer 2473*, h and i from *B. Archer 2479*.

Conservation status: CALM Conservation Code for Western Australian Flora: Priority Two. Known with certainty from two disjunct populations. The population east of Cunderdin consists of a few scattered plants, but the population south of Woolgangie consists of hundreds of plants dispersed over a wide area.

Typification: Bentham based his concept of *B. concinna* on three syntypes: '*Drummond, 5th Coll. n.* 81, *and Suppl.* [to 5th coll.] *n.* 41 (very spinescent specimens with dark-coloured flowers); Grass-tree plains between M'Callum and Stokes Inlets, *Maxwell* (more leafy and less spinescent, with apparently bright yellow flowers).' The syntypes represent three taxa. The difficulty in applying the name *B. concinna* subsequent to its publication explains why it has been used infrequently, and then tentatively. As the description of *B. concinna* in the protologue was based on discordant elements, it is necessary to select a lectotype from among the syntypes.

Bentham characterised *B. concinna* as 'A glabrous spinescent shrub allied to *B. Preissii*, but with smaller flowers, different in the proportion of the petals and an almost sessile pod'. Both of the *Drummond* syntypes are flowering specimens. Only the *Maxwell* syntype bears flowers and young pods. It is clear from the protologue that different elements of the composite description were derived from each of the three syntypes. For example, the leaf margins were described as 'often slightly recurved', an observation that could only have come from one or both of the *Drummond* specimens. The pedicels were described as 'about as long as the leaves', which characterises *Drummond 81* and the *Maxwell* specimen; in *Drummond 41* the pedicels exceed the leaves in length. The ovary was described as 'glabrous'. In *Drummond 41* the ovary is completely glabrous whereas in *Drummond 81* and the *Maxwell* syntype there are scattered hairs along one or both marginal sutures. The description of the pods was almost certainly taken from the *Maxwell* syntype as it is the specimen in which the pods are best developed, Bentham having noted that the pods were 'not quite ripe in our specimens.'

Bentham described the bracteoles as 'deciduous'. Oddly, on each of the syntypes at K which Bentham saw the bracteoles are invariably persistent. However, on a second sheet of *Drummond, 5th coll., n. 81* presented to K in 1915 by the Linnean Society of London and on the MEL sheet of *Drummond, 5th coll, n. 81* (MEL *651104*) the bracteoles are caducous. Bentham certainly could not have seen the specimen in MEL as it was acquired by Mueller directly from James Drummond's son in 1866 subsequent to Bentham's publication of his treatment of *Bossiaea* in *Flora Australiensis*. It is possible that he saw a specimen in the possession of W.W. Saunders which passed to the Linnean Society of London before being presented by the Society to K in 1915. Saunders was the Treasurer of the Linnean Society for most of the years that Bentham was President (Desmond, 1994). This specimen is not annotated by Bentham. However, regardless of whether or not Bentham saw the specimen, it is evident that the bracteoles in *B. concinna* may be either caducous or persistent.

I here select from amongst the syntypes the sheet of *Drummond* Suppl. [to the 5th collection] *n. 41* at K as the lectotype of *B. concinna*; a sheet at MEL (*651105*) is an isolectotype. There are also in MEL two sheets (*653787* and *664836*) of unnumbered Drummond material that match the specimen numbered *41*, although much larger than it. I have not seen any other specimens of this taxon amongst Drummond's collections and, although they are unnumbered, it seems reasonable to assume that these two sheets in MEL are probable isolectotypes. They are treated thus here. The precise provenance of *Drummond suppl. to 5th coll, no. 41* is not known. It was possibly collected near the western extremity of the range of distribution of the species somewhere near the vicinity

of Cunderdin. Drummond is known to have visited the upper reaches of the Salt River near Cunderdin in 1839.

Of the two remaining syntypes of *B. concinna*, the *Maxwell* specimen is referable to *B. preissii* and represents the variant of that species with small flowers. *Drummond* 5th *coll. n. 81* is referred hesitantly to *B. atrata*. I had thought initially to select *Drummond* 5th *coll. no. 81* as the lectotype of *B. concinna* but the uncertainty over the circumscription of the taxon to which the name *B. concinna* would then apply persuaded me rather to select as lectotype *Drummond Suppl. no. 41* which represents a reasonably well circumscribed taxon.

An element of doubt exists over whether or not the *Drummond n. 81* syntype of *B. concinna* was part of Drummond's 5th collection as Bentham cited as the type of *B. strigillosa* '*Drummond, 5th coll.?, n.* 81'. This latter specimen, also in Herbarium Hookerianum at K, represents a different taxon (*Pultenaea rotundifolia* (Turez.) Benth.) and is not to be confused with the syntype of *B. concinna*. Clearly one of these specimens has been attributed incorrectly to Drummond's 5th collection which provides another example of the confusion associated with Drummond's system of numbering specimens.

Notes: *Bossiaea concinna* is a member of the group of spinescent essentially glabrous species with the young branchlets glabrous or with occasional scattered hairs, glabrous calyces, and apically woolly-pubescent keel apices. *Bossiaea concinna* differs from *B. atrata* in having narrow glaucous leaves in which the upper surface of the lamina is typically convex in section, the lamina sloping towards the margins on either side of the midrib, in lacking dark red to purplish pedicels and calyces, and in its preferred habitat above the samphire zone on the perimeter of salt lakes. As far as is known, *B. atrata* is not associated with salt lakes. *Bossiaea concinna* differs from *B. spinescens* in having terete to oval angled young branchlets rather than distinctly flattened and narrowly winged branchlets, narrow glaucous leaves in which the petiole is attached at the base of the lamina rather than almost at right angles to it, and in its preference for the perimeter of salt lakes.

Bossiaea concinna is reminiscent of *B. barbarae* from which it differs in having glabrous young stems (apart from hairs in the leaf axils), a different leaf shape (lamina typically convex in section with a rounded apex as opposed to flat or v-shaped in *B. barbarae* with a depressed-retuse apex), the ovary glabrous throughout or with scattered hairs on the lower suture towards the apex, and longer pedicels that exceed the leaves.

Bossiaea aurantiaca differs from *B. concinna* in having young branchlets sparingly to densely clothed with appressed to slightly spreading antrorse hairs, short sparingly pubescent pedicels, sparingly pubescent calyces, and a different flower colour.

Hislop et al. 3307B from NE of Pithara and *Hislop 3058* from NW of Jerramungup were collected from saline or subsaline habitats. Large geographical disjunctions separate these two specimens from each other and from the Cunderdin and Woolgangie populations of *B. concinna*. Neither specimen is typical of the plants in the Cunderdin and Woolgangie populations, but both can be accommodated in *B. concinna* pending further investigation.

22. *Bossiaea inundata* J.H.Ross, sp. nov.

B. spinescentiae Meisn. affinis, a qua ramulis juvenilibus teretibus ovalibus angularibus, petiolo neque ad superficiem abaxialem folioli fere affixio, differt

Type: Irwin Botanical District, Kalbarri National Park, bed of the Murchison River upstream of the Ross Graham Lookout, 19 Nov.1998, *J.H. Ross 3998*; PERTH: holo.; MEL *2275336*, iso.

Spreading open shrub to 1 m high with numerous slender relatively unbranched stems arising from the base; young branchlets terete to oval in section and angled with a conspicuous raised decurrent ridge below the point of attachment of each leaf but not flattened and winged, glabrous or with occasional scattered hairs especially when young, the abbreviated lateral shoots terminating in a pungent point. Leaves alternate or appearing fascicled, unifoliolate; lamina oblong, narrowly obovate-oblong, obovate or elliptic, (2–) 3–6 mm long, 1.2–2.0 (–3.5) mm wide, with margins not recurved, upper surface glabrous, lower surface glabrous throughout or with scattered hairs along the midrib, with venation usually indistinct apart from the conspicuous midrib but simple craspedodromous or semicraspedodromous; petiole 0.3–0.9 mm long, glabrous or with scattered hairs. Stipules subulate, 0.5–1 mm long, usually shorter than the petiole, glabrous, persistent. Flowers solitary or often pseudoracemose, often borne on short lateral spinescent branches, the pedicels 2–5 mm long, glabrous; bract often solitary, oblong, 0.8–1.1 mm long, usually almost appressed to the pedicel, scarious, with marginal cilia, usually caducous; bracteoles obovate-oblong, 6–1.1 mm long, usually attached near or above the middle of the pedicel, sparingly to densely ciliate apically, invariably caducous and leaving two prominent opposite or subopposite scars on the pedicel. Calyx glabrous externally except for marginal hairs at the apex of the lobes, green suffused with red almost throughout or green apart from a red tinge along the median line of the two upper lobes and the tips of the three lower lobes; 2 upper lobes truncate, 0.7–1.2 mm long excluding the tube 2.3–3.5 mm long, with 3 lower lobes 0.5–0.8 mm long, acute, shorter than the tube. Standard 7.8–9.0 mm long including a claw 2.6–4.0 mm long, 7.3–8.5 mm wide, longer than the keel, deep yellow internally with a red or pinkish-red horseshoe-shaped basal flare surrounding two greenish-yellow 'eyes' in the throat and often with a fine red margin, externally the basal greenish-yellow 'eyes' surrounded by a red zone that extends to the apex of the standard and with red striations radiating into the yellow lateral margins; wings 7.0–7.6 mm long including a claw 2.6–3.5 mm long, 1.8–2.6 mm wide, externally pinkish-red; keel 5.2–6.0 mm long including a claw 2.5–3.0 mm long, 2.1–2.5 mm wide, densely woolly pubescent apically in the sinus, externally green basally, pinkish-red apically. Stamen-filaments 4.5–6.1 mm long. Ovary 3.2–4.0 m long, on a stipe 1.0–1.5 mm long, 6- or 7-ovulate, glabrous apart from scattered hairs on the lower suture. Mature pods not seen (Fig. 31).

Distribution and habitat: Confined to the Irwin Botanical District of the Southwestern Botanical Province where it is recorded from the Murchison river gorge in the Kalbarri National Park (Fig. 28). Occurs amongst boulders (Tumblagooda sandstone) in the bed and on the banks of the Murchison River where it is subject to periodic inundation. Most plants grow rooted firmly in crevices in or between the boulders where they have to withstand the force of a considerable torrent when submerged. Associated with *Eucalyptus camaldulensis* Dehnh., *Melaleuca* sp., *Grevillea* sp. and *Labichea lanceolata* Benth. subsp. *lanceolata*. Flowers May–Sept.

Representative specimens (12 examined): Murchison Gorge, 19 Aug.1961, *C.A. Gardner 13197* (PERTH); Murchison River, below Ross Graham Lookout, 8 May1968, *P.G. Wilson 6617* (PERTH); 26 Sept.1982, *M.G. Corrick 8265*, (MEL, PERTH); 17 Sept. 2000, *J.H. Ross 4091* (MEL, PERTH).

Conservation status: CALM Conservation Code for Western Australian Flora: Priority Two.

Notes: *Bossiaea inundata* is allied to *B. spinescens* from which it differs in having terete to oval angled young branchlets and the petioles are not attached almost at right angles to the leaf lamina. In *B. inundata* the braeteoles are invariably caducous and leave two prominent opposite or subopposite scars on the pedicel whereas in *B. spinescens* the braeteoles usually persist until the young pods start to develop. The habitat of *B. inundata* and its ecological tolerances are quite different to those of *B. spinescens*.

Bossiaea concinna and *B. atrata*, two other spinescent essentially glabrous species with glabrous calyces and apically woolly-pubescent keel apices, are both much more rigid, dense and intricately branched shrubs than *B. inundata*, have different ecological preferences, and differ in other respects.

Apart from the Gardner specimen which lacks a precise locality, all of the others were collected in the Murchison River gorge slightly upstream of the Ross Graham Lookout. A steep path from this Lookout descends to the river and the population of about one hundred plants is readily accessible. As far as is known, the plants are confined to an area immediately upstream of this lookout. A brief search in late September 2000 below the Hawks Head Lookout revealed no plants of this taxon, but the rugged terrain prevented a thorough search. A search upstream where the North West Coastal Hwy crosses the Murchison River did not reveal any plants.

When the population was visited in September 2000, at first sight all of the plants appeared to be dead, only dead brown slender stems being evident. However, closer inspection revealed regeneration from the base of most plants and the production from each of a few new stems, some bearing a few flowers. Presumably the plants had been submerged for a long period following the passage of a cyclone at the beginning of that year. This periodic inundation may prevent the plants from growing into larger shrubs.

Etymology: From the Latin *inundatus*; in reference to the habitat occupied by the species that results in the plants being inundated during years of high rainfall.

23. *Bossiaea atrata* J.H.Ross, sp. nov.

B. concinnae Benth. affinis, a qua lamina oblonga obovata-oblonga anguste elliptica ad fere rotunda atrovirens plana vel v-formata ad fere conduplicata, et pedicellis et calycibus atrorubis, differt.

Type: Western Australia, Avon District, 4.8 km [3 miles] E of Manmanning, 14 Aug.1990, *B.H. Smith 1292*; holo.: PERTH; iso.: CANB, MEL *2011034*.

B. concinna Benth, *Fl. Austral.* 2: 161 (1864) pro parte quoad specim. *Drummond* 5th *coll. no. 81*.

Compact dense intricately branched rigid spinescent shrub to 1.2 m high and 1 m wide; young branchlets terete to oval in section and angled with a raised decurrent ridge below the point of attachment of each leaf but not winged, glabrous or with few scattered hairs especially when young, the hairs on the apices of axillary bracts often appearing as a tuft of hairs in the leaf axils, the abbreviated lateral shoots terminating in a pungent point. Leaves alternate, unifoliolate; lamina oblong, narrowly obovate-oblong, elliptic to almost rotund, 1.5–4.2 mm long, 1.1–2.2 mm wide, flat or v-shaped to almost conduplicate, with margins not recurved, apex rounded to slightly acute, upper surface glabrous, lower surface glabrous throughout or sometimes with a few scattered hairs at the apex, coriaceous, with venation usually indistinct apart from the conspicuous midrib but simple craspedodromous; petiole 0.4–1.0 mm long, glabrous.

Figure 31. *Bossiaea inundata* – a, flowering twig, × 1; b, calyx opened out (upper lobes on right) and pedicel showing the scars that mark the points of attachment of the caducous bracteoles, × 4; c, standard, × 4; d, wing petal, × 4; e, keel petal, × 4; f, fruiting twig, × 1. a, from *Corrick 8265*, b–e from *Ross 3998*; f from *Ross 4091*.

Stipules subulate, narrowly triangular or ovate-oblong, 0.5–1.2 mm long, longer or shorter than the petiole, glabrous or with apical marginal cilia, scarious, persistent. Flowers solitary or pseudoracemose, often borne on the short lateral spinescent branchlets, the pedicels 3–7 mm long, glabrous, dark purplish-red, usually longer than the leaves; bracts several, scarcely imbricate, the innermost largest, ovate or oblong, 0.5–2.0 mm long, sparingly to densely pubescent apically, sometimes persisting until the young pods start to develop; bracteoles narrowly ovate or obovate-oblong, obovate or linear, 0.9–1.6 mm long, inserted towards the middle of the pedicel, pinkish-red, glabrous or sparingly to densely pubescent apically, usually persisting until at least the young pods develop. Calyx glabrous externally except for marginal hairs at the apex of the lobes, dark red or purplish; 2 upper lobes truncate, 1.2–2.2 mm long excluding the tube 2.1–3.8 mm long, with 3 lower lobes 0.7–1.5 mm long, subacute, shorter than the tube. Standard 7.5–10.0 mm long including a claw 2.2–3.8 mm long, 8.8–10.6 mm wide, longer than the keel, orange-yellow internally with a deep red or reddish-brown basal flare around a yellow throat and sometimes with a fine dark margin, externally dark red basally with red striations radiating into the orange-yellow margin; wings 7.2–8.3 mm long including a claw 3.0–3.6 mm long, 2.3–2.5 mm wide, externally orange-yellow basally, dark red apically; keel 6.2–7.0 mm long including a claw 2.7–3.3 mm long, 2.8–3.2 mm wide, externally orange-yellow basally, dark red apically, densely woolly pubescent apically in the sinus. Stamen-filaments 4.5–6.9 mm long. Ovary 3.5–5.0 mm long, on a stipe 0.8–1.0 mm long, 5–8-ovulate, usually completely glabrous but sometimes with scattered hairs on the lower suture towards the apex. Pods 1.2–2.5 cm long, 0.4–0.7 cm wide, on a stipe about as long as or just exceeding the calyx, with valves pinkish-red when young but pinkish-brown or dark brown at maturity, inconspicuously venose, glabrous or occasionally with scattered hairs on the lower suture. Seeds 2.8–3.6 mm long, 1.8–2.4 mm wide, uniformly pale creamy-brown or pale pinkish-brown (Fig. 32).

Distribution and habitat: Occurs sporadically in the Avon and Roe Botanical Districts from the vicinity of Manmanning in the north south-eastwards to east of Lake Grace and to Hatter Hill north-east of Lake King in the south (and possibly to the vicinity of Ongerup) (Fig. 28). Favours white sand over laterite, quartzy sand, sandy loam over laterite or clay in open *Eucalyptus wandoo* woodland, open mallee and rich shrubland. Flowers May–Aug.

Representative specimens (32 examined): 0.3 km SE of Hatter Hill, 8 Aug.1979, *K. Newby 5454* (PERTH). 2 miles [3.2 km] SW of Manmanning, 23 June 1984, *B.H. Smith 383* (AD, CANB, HO, MEL). 6.5 miles [10.4 km] E of Dowerin-Kalannie Rd, 4 June1986, *B.H. Smith 649* (CANB, HO, MEL, NSW, PERTH). Dragon Rocks Nature Reserve No. 36128, eastern section N of Varley, 17.viii.1991, *A.M. Coates 2585* (MEL, PERTH). Lake King Nature Reserve, 16 Aug.1995, *M.S. Graham 512* (PERTH). Railway line reserve, 3 km W of Buniche, 27 Aug.1995, *E. Bishop 55A* (MEL, PERTH). Namaleatching Nature Reserve, between Goomalling and Wyaleatchem, 27 Oct.1996, *M.D. Crisp 9033* & *W. Keys* (CANB, MEL). 22.1 km W of Newdegate on Newdegate–Lake Grace Rd, 28.xi.1996, *J. H. Ross* 3870 (MEL, PERTH).

Conservation status: CALM Conservation Code for Western Australian Flora: Priority Three. Nowhere common, usually occurring in small populations or as solitary plants. In the Manmanning area populations occur on private land, along road verges and a railway reserve. The roadside plants are at risk from being smothered by weeds or eradicated through road-widening activities.

Notes: *Bossiaea atrata* differs from *B. concinna* in having a typically thicker oblong, narrowly obovate-oblong, elliptic to almost rotund dark- or olive-green leaf lamina

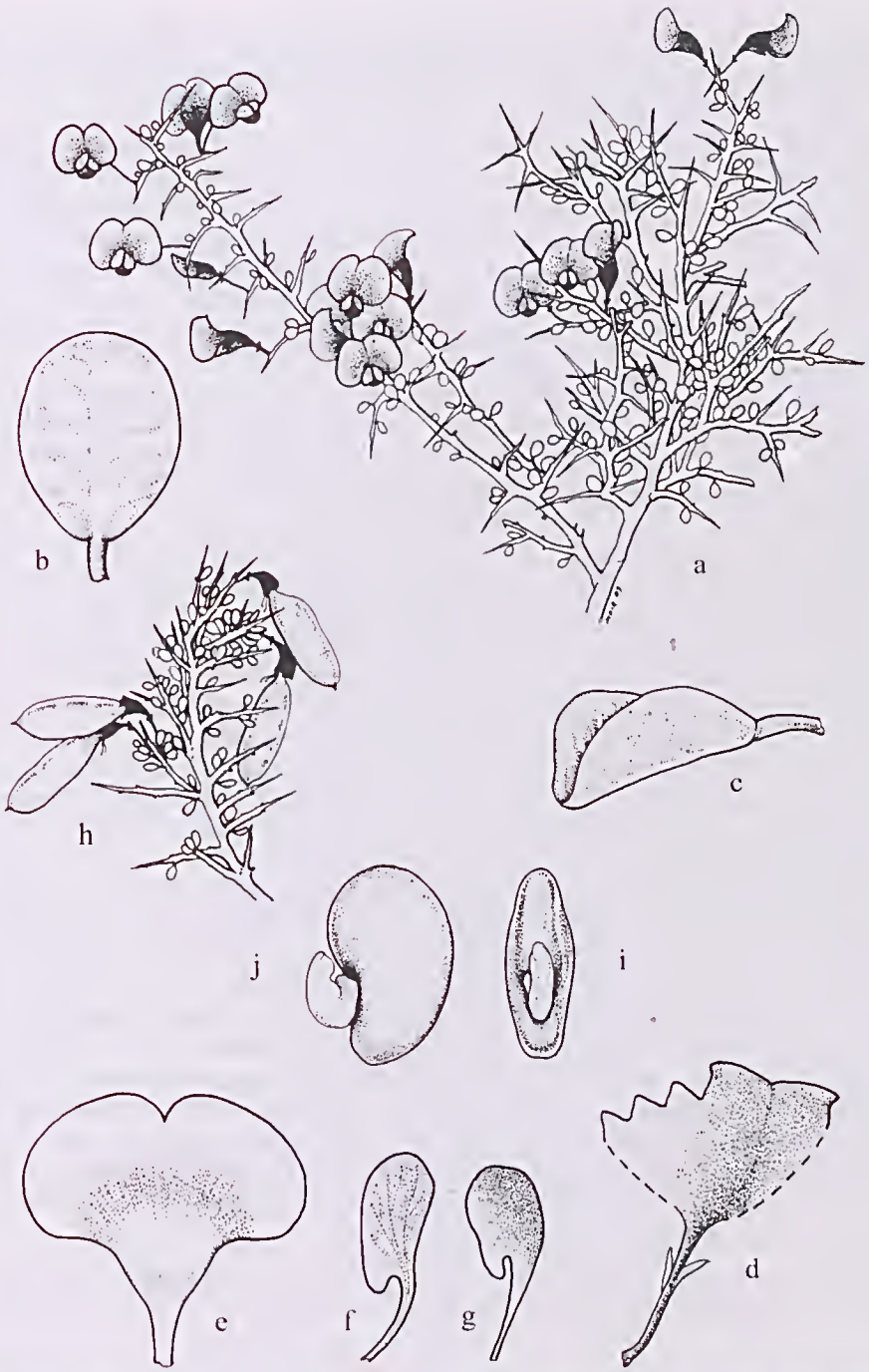

Figure 32. *Bossiaea atrata* – a, flowering twig, × 1; b, flat leaf lamina typical of the northern populations, × 10; c, almost conduplicate leaf lamina typical of some of the southern populations, × 10; d, calyx opened out (upper lobes on the right), × 4; e, standard, × 4; f, wing petal, × 4; g, keel petal, × 4; h, fruiting twig, × 1; seed, hilar view, × 8; j, seed, lateral view, × 8. a, b, d–g from *Smith 1292*; c from *Coates 2585*; h–j from *Smith 1711*.

which is flat or v-shaped to almost conduplicate, and dark red to purplish pedicels and calyces. As in *B. concinna,* the pedicels usually exceed the leaves. Unlike *B. concinna*, *B. atrata* does not favour the samphire zone above the perimeter of salt lakes.

Bossiaea atrata appears to have a disjunct distribution and occur sporadically with a northern distribution centred around Manmanning and a southern distribution extending from Dragon Rocks to north-east of Lake Grace and Hatter Hill north-east of Lake King. The material from the Manmanning area is fairly homogeneous and the leaf-lamina is typically flat, the young foliage is flushed with red, and the young pods are tinged with red. In the south the leaf lamina is often canaliculate to almost conduplicate but the material agrees otherwise with material from the northern populations and has dark red or purplish calyces and pedicels.

Bossiaea atrata differs from *B. spinescens* in having a dark red or purple calyx and pedicels, thicker, different shaped leaves, and terete to oval rather than flattened young branchlets. *Bossiaea preissii* differs in having larger pendulous differently-coloured flowers, the standard petal is usually slightly shorter than the keel petals, and the leaves are larger.

Drummond 5th coll. no.81, one of the syntypes of *B. concinna,* consists of several slender elongated relatively unbranched distal shoots which appear to represent growth of the current season that had possibly arisen directly from a rootstock. I have not seen another *Bossiaea* specimen that is a good match of this syntype, and the search for more material was hampered by the absence of any indication of the provenance of *Drummond 5th coll. no.81* (assuming that the syntype is part of his 5th collection) or of its ecological preferences. Erickson (1969) recorded that Drummond's 5th collection was from 'Stirling Ra., Pallinup R., Mt. Barren Ra., C. Riche'. Given that searches for every other taxon of *Bossiaea* in Western Australia have been successful, it is surprising that no other material has been collected that is a good match of this Drummond syntype. The specimen is referred hesitantly to *B. atrata.*

Two specimens from the area between Pingrup and Ongerup, *Newby 932* (PERTH), 12 Sept.1963, 3.2 km N of Ongerup, and *C.E. & D.T. Woolcock s.n.* (MEL *694628*), 9 Sept.1982, 10 km S. of Pingrup, are reminiscent of *Drummond 5th coll. no. 81.* The ovaries have scattered hairs on both sutures, but the flowers tend to be smaller and the leaf lamina tends to be flat rather than convex. In the former the bracteoles are persistent, in the latter persistent or caducous. These two specimens are referred here hesitantly to *B. atrata.* Searches in 1996 and 1998 in the general areas from which the Newby and Woolcock specimens were thought to have been collected failed to locate any plants. These localities fall within the area that Drummond could have covered while accumulating his 5th collection. The label accompanying *Newby 932* indicates that the plant was '12 to 18 inches high in granitic soil' but there is no indication of flower colour. The Woolcock specimen lacks any notes.

Etymology: From the Latin *atratus*; in reference to the dark pedicels and calyces that help to characterise the species.

24. *Bossiaea aurantiaca* J.H.Ross, *sp. nov.*

B. concinnae Benth. affinis, a qua ramulis juvenibus parce versus dense adpressis ad antrorsos effusos pilis vestitis, calycibus parce pubescentibus, differt.

Type: Western Australia, Coolgardie District, NW of Norseman P.O., 2 Oct.1998, *J.H. Ross 4052 & B. Archer*; holo.: PERTH; iso.: AD, CANB, K, MEL *2149957*, NSW.

Compact rounded or spreading spinescent shrub to 1.5 m high and 2.2 m wide; young branchlets terete to oval in section, slightly angled with an inconspicuous raised decurrent ridge below the point of attachment of each leaf, sparingly to densely clothed with appressed to slightly spreading antrorse hairs, glabrescent, sometimes with a thin white waxy outer layer that exfoliates, the abbreviated lateral shoots often slightly deflexed, terminating in a pungent point. Leaves alternate or appearing fascicled, unifoliolate; lamina oblong to narrowly obovate-oblong, 3.3–7.3 mm long, 0.8–1.4 mm wide, lamina sloping down on either side of midrib so upper surface usually slightly convex, with the margins slightly recurved, apex rounded, upper surface shiny, glabrous or with few scattered hairs when young but glabrescent, lower surface sparingly to densely clothed with appressed hairs especially on the midrib, glabrescent, with venation obscure but simple craspedodromous, the lateral veins inserted at an acute angle or almost at right angles to the midrib; petiole 0.5–1.0 mm long, glabrous to densely clothed with appressed hairs. Stipules subulate, 0.6–1.5 mm long, shorter or longer than the petiole, persistent. Flowers solitary or pseudoracemose, the pedicels 2–4 mm long, sparingly clothed with scattered appressed hairs; bract often solitary, oblong, 0.9–1.3 mm, brown, caducous or persistent; bracteoles oblong or obovate-oblong, 0.8–1.3 mm long, inserted from near the base to near the apex of the pedicel and occasionally just overlapping the base of the calyx, brown, scarious, margins ciliate especially apically and sometimes with scattered hairs along the midline, usually persistent until at least the young pods start to develop. Calyx green but upper surface and lobes suffused with red and tips of three lower lobes red, usually with scattered appressed hairs externally, the hairs often prominent at the base, occasionally almost glabrous apart from hairs on the margins of the lobes; 2 upper lobes rounded-truncate, 1.0–1.8 mm long excluding the tube 2.0–2.9 mm long, with 3 lower lobes 0.9–1.8 mm long, acute to acuminate, shorter than the tube. Standard 8.3–9.3 mm long including a claw 3.5–4.0 mm long, 7.2–8.5 mm wide, longer than the keel, internally golden yellow with a basal horseshoe-shaped pinkish-red flare around a paler yellow throat, externally yellow basally with yellow striations radiating into the lamina which is suffused with pinkish-red except towards the lateral yellow margins; wings 7.3–7.6 mm long including a claw 1.8–2.7 mm long, 1.5–2.2 mm wide, pinkish-red; keel 6.3–6.9 mm long including a claw 2.4–3.0 mm long, 2.1–2.4 mm wide, green basally, pinkish-red apically, densely woolly pubescent apically in the sinus. Stamen-filaments 5.2–7.5 mm long. Ovary 4.0–4.6 mm long, on a stipe 1.3–1.5 mm long, 4– or 5-ovulate, usually densely clothed with appressed hairs along the sutures. Pods 0.9–1.7 cm long, 3.8–5.0 mm wide, on a stipe not exceeding the calyx, with valves pale yellowish- to pinkish-brown, inconspicuously transversely venose, glabrous apart from hairs along both sutures. Seeds 2.5–2.7 mm long, 1.5–1.6 mm wide, uniformly pale creamy-brown (Figs 33, 34e).

Distribution and habitat: Occurs in the Coolgardie Botanical District of the Southwestern Interzone in an area centred on Norseman (Fig. 28). The two largest populations occur in red sand and red clay-loam in mallee *Eucalyptus* scrub in association with *Triodia scariosa*. Favours low-lying situations where run-off from higher ground increases the level of soil moisture; in winter these soils become sticky. Flowers Sept.–Oct.

Representative specimens (16 examined): 5 miles [8 km] N of Norseman towards Coolgardie, 4 Sept.1968, *M.E. Phillips s.n.* (CANB, PERTH). 10 km N of Norseman, 22 Sept.1982, *C.E. Woolcock s.n.* (MEL). Mt Norcott, 29 km E of Norseman, 17 Sept. 2000, *B. Archer 1649* (MEL, PERTH). Picnic Lake, 27 km SW of Norseman, 25 Sept. 2000, *J.H. Ross 4102 & B. Archer* (CANB, MEL, PERTH); 26 Nov. 2000, *B. Archer 1782* (MEL, PERTH).

Conservation status: CALM Conservation Code for Western Australia: Priority 2. Known from three populations NW, SW and E of Norseman. Seedling recruitment was evident at all three populations in September 2000.

Notes: The narrow oblong to narrowly obovate-oblong leaves distinguish *B. aurantiaca* from *B. calcicola*, the only other spinescent species with sparingly pubescent calyces. In addition, the two species have quite different distributions and ecological preferences. Likewise, leaf shape distinguishes *B. aurantiaca* from the variant of *B. barbarae* from near Lake Koorkoordine that has occasional scattered hairs on the calyx.

Although no individual flower part is orange, the combination of yellow, pink and red, imparts an orange hue from a distance and, when in flower, the flowers typically appear distinctly orange.

A visit to the Mt Norcott population in September 2000 revealed that the flowers on many plants were essentially red. Inspection of these red-flowered plants showed that the standard petals were malformed, reduced in size, and uniformly red instead of having a partial yellow lamina internally and externally. In contrast to the plants with 'normal' standards at Mt Norcott that produced pods in profusion, none of the plants with malformed standards subsequently produced many pods. This suggests that the normal pollinators were not as effective when the standards are malformed.

Etymology: From the Latin *aurantiacus*; in reference to the orange hue imparted by the flowers.

25. Bossiaea eremaea J. H. Ross, sp. nov.

B. spinescentiae Meisn. affinis, a qua strato albo cereo ramorum juvenium desquamato cito, foliis plerumque ad ramos juvenes limitatis caducis cito, petalis carinae apicibus glabris vel pilis aliquot dispersis, differt.

Type: Western Australia, 129 km E of Mount Magnet on Mount Magnet-Sandstone rd, 21 Sept.1998, *J.H. Ross 4004*; holo.: PERTH; iso.: CANB, K, MEL *2149939*.

Divaricately branched spreading shrub to 1.2m high and 1.5m wide; bark on old stems yellowish-brown, rough, peeling off in short longitudinal strips; young branchlets terete to oval in section or slightly flattened but not winged, not incised at the nodes, sparingly to fairly densely pubescent, glabrescent, covered with a white waxy outer layer that rapidly exfoliates to reveal a pitted green inner layer, usually terminating in a bluntish point. Leaves usually confined to the young growth, mostly soon caducous so that often the plants are apparently leafless, alternate or on short axillary shoots and appearing fascicled, unifoliolate; lamina oval, elliptic to obovate-oblong, 2.2–6 (–8.5) mm long, (0.7–) 1.7–3.5 (–4.7) mm wide, usually emarginate apically and sometimes almost bilobed, usually attached almost abaxially to the petiole, upper surface glabrous, lower surface glabrous or with scattered hairs along the midrib or sometimes also on the lamina, with venation simple craspedodromous; petiole 0.5 –1.0 (1.6) mm long, glabrous or with scattered hairs. Stipules ovate to narrowly ovate, 0.6 –1.2 (–2.1) mm long, laterally confluent basally and oblique, turning black and persisting, with marginal cilia especially apically. Flowers solitary or pseudoracemose at the nodes, the pedicels 1–5 mm long, glabrous or with occasional scattered hairs; bracts imbricate, increasing in size up the length of the pedicel, the inner broadly ovate, 0.8–1.3 mm long, 0.6–1.0 mm wide, scarious, concave, with conspicuous marginal cilia and scattered hairs externally along the midline especially apically, persistent; bracteoles broadly ovate, narrowly

Figure 33. *Bossiaea aurantiaca* – a, flowering twig, × 1; b, calyx opened out (upper lobes on right), × 4; c, standard, × 4; d, wing petal, × 4; e, keel petal, × 4; f, gynoecium, × 4; g, ovary enlarged to show the appressed hairs along the sutures, × 20; h, fruiting twig, × 1; i, seed, hilar view, × 10; j, seed, lateral view × 10. a–g from *Ross 4052 & B. Archer*; h–j from *B. Archer 1192*.

Figure 34. Photographs of a, *Bossiaea praetermissa*; b, *B. halophila*; c, *B. cucullata*; d, *B. walkeri*; e, *B. aurantiaca*. Photographs by Barbara Archer.

ovate or obovate, 1.1–1.5 mm long, 0.7–1.4 mm wide, inserted in lower half of pedicel, with conspicuous marginal cilia and hairs externally at the apex of the midline, caducous or persistent. Calyx green basally and pinkish-red for most of its length in flower, turning dark red or purplish when young pods are developing, glabrous externally except for hairs on the margins of the lobes; 2 upper lobes 0.9–1.9 mm long excluding the tube 2-4 mm long, truncate, with 3 lower lobes 0.8–1.2 mm long, acute, shorter than the tube. Standard 6.8–10.1 mm long including a claw 2.5–5.0 mm long, 7.5–9.7 mm wide, longer than the keel, internally deep yellow with a purplish-brown basal horseshoe-shaped flare enclosing 2 pale yellow 'eyes' around a red throat, externally red basally surrounded by a purplish-brown zone that radiates into the orange-yellow margins; wings 6.1–8.5 mm long including a claw 2.3–3.5 mm long, 2.0–2.9 mm wide, externally pinkish-red basally passing to purplish-brown and yellow apically; keel 5.8–8.1 mm long including a claw 2.6–3.5 mm long, 2.6–3.8 mm wide, externally purplish-red basally, darker apically, glabrous. Stamen-filaments 4.8–7.5 mm long. Ovary 4.0–5.8 mm long, on a stipe 1.0–1.7 mm long, 5–7-ovulate, glabrous. Pods 1.6–2.0 cm long, on a stipe shorter than or as long as the calyx-tube, 0.6–0.8 cm wide, with valves purplish-blue when very young but reddish-brown when mature, inconspicuously venose, glabrous. Seeds not seen (Fig. 36).

Distribution and habitat: Occurs in the eastern portion of the Austin Botanical District and the extreme western portion of the Helms Botanical District from west of Sandstone in the north-west, south-eastwards to east of Laverton (Fig. 37). Grows in open *Eucalyptus* woodland on deep red sand. In the type locality usually growing in association with or beneath *E. gongylocarpa* Blakely and *E. oldfieldii* F.Muell. Flowers July to Sept.

Representative specimens (10 examined): 16 km W of Sandstone, 14 or 15 Aug.1931, *C.A. Gardner & W.E. Blackall 476* (PERTH); 27.2 km W of Sandstone, 17 Aug.1931, *C.A. Gardner 2507* (PERTH); 19.2 km E of White Cliffs H.S., E of Laverton, 2 July 1963, *A.S. George 4559* (MEL, PERTH); SE of Merolia Stn, 20 July1989, *H. Pringle 2450* (PERTH); 136 km E of Mount Magnet on Mount Magnet-Sandstone Rd, 21 Sept.1998, *J.H. Ross 4007* (CANB, MEL, NSW, PERTH).

Conservation status: CALM Conservation Code for Western Australia Flora: Priority Two.

Notes: *Bossiaea eremaea* is a very distinctive species that is distinguished by a combination of the following characters: the whitish waxy layer on the young stems and branches that soon exfoliates to reveal a green pitted inner layer, the usually emarginate leaves that are largely confined to the young growth and are mostly soon caducous, the bracteoles inserted in the lower third of the pedicel and the glabrous keel petals. Once the leaves have been shed, plants are superficially reminiscent of some of the leafless species with narrow cladodes, but the stems of *B. eremaea* are not incised at the nodes, are stipulate, and lack the persistent scale leaves of these leafless species. The purplish-blue young pod valves are very distinctive.

Bossiaea eremaea is reminiscent of *B. spinescens* but differs in having a white waxy outer layer on the young branchlets that soon exfoliates, the leaves confined to the young growth and soon caducous, and the apices of the keel petals glabrous or with only scattered hairs. The petiole in *B. eremaea* usually forms a distinct angle with the leaf lamina in a manner reminiscent of *B. spinescens*.

The young branchlets of *B. eremaea* usually terminate in a bluntish point rather than in a sharp pungent point as in many other species. *Bossiaea spinosa* and *B. divaricata* are the only species amongst the spinescent species that have keels with glabrous apices.

The glabrous ovaries and emarginate caducous leaves distinguish *B. eremaea* from *B. spinosa* and *B. divaricata* which both have densely villous ovaries and, furthermore, its distributional range and ecological preferences are quite different.

Wind-blown sand tends to accumulate around the base of plants and individual older plants sometimes spread by layering.

In the type locality in 1998 most plants were heavily infested with spherical and/or fusiform galls inhabited by members of the superfamily Chalcidoideae. The family in question is not known but is thought to be either Pteromalidae, Eulophidae, Torymidae or Eurytomidae (C. McPhee, pers. comm.). Initially it was thought that the insects inhabiting the galls may be responsible for defoliating the plants but apparently this is not the case. Similar galls were noted on the specimen collected near White Cliffs H.S. and have been observed occasionally on other species of *Bossiaea*.

Etymology: From the Greek, *erēmaios*, desert; in reference to the occurrence of the species on deep sand in the Eremaean Botanical Province.

26. *Bossiaea rufa* R.Br. in W.T.Aiton, *Hortus Kew.* edn 2, 4: 267 (1812); DC., Prodr. 2: 117 (1825). *Type*: 'Nat. of the South-West Coast of New Holland. Robert Brown, Esq.'; King Georges Sound, *R. Brown 4831*; lecto.: BM; isolecto.: CANB, PERTH.

Bossiaea paucifolia Benth. in Lindley, *Edwards's Bot. Reg.* 27 misc.: 53, no. 108 (1841), non sensu Lindley, *Edwards's Bot. Reg.* 29: 63 (1843); Walp., *Repert. Bot. Syst.* 1: 578 (1842); Meisn. in J.G.C.Lehmann, *Pl. Preiss.* 1: 81 (1844). *Type*: 'A little Swan River bush .....I have been favoured with specimens by R. Mangles Esq. of Sunning Hill, and by Messrs. Lowe and Co. of Clapton and it has also flowered in the gardens of the Horticultural Society.'; Swan River, 1839, *J. Drummond*; lecto.: CGE.

Bossiaea virgata Hook., Bot. Mag. t.3986 (1842); Walp., *Repert. Bot. Syst.* 2: 833 (1843). *Bossiaea rufa* var. *virgata* (Hook.) Benth., *Fl. Austral.*2: 166 (1864). *Type*: 'A Swan River species, detected and introduced to this country by Mr James Drummond, by seeds, received by Mr Murray in the Glasgow Botanic Garden, where the plant flowered in June, 1842.'; Swan River, *J. Drummond 1st coll., no. 56*; lecto.: K.

Bossiaea rufa var. *normalis* Benth., *Fl. Austral.* 2: 166 (1864). Type as for *B. rufa*.

Lax many-stemmed shrub to 2 m high, stems erect or straggling and supported by surrounding vegetation, flattened, winged, 1.5–10 mm wide, incised at the nodes, glabrous or sparingly clothed with appressed or slightly spreading hairs especially when young. Leaves present or absent, when present usually confined to the young growth, alternate, unifoliolate; lamina obovate, obovate-oblong, elliptic to narrow-elliptic, 7–29 mm long, 2.2–10.0 mm wide, rounded, obtuse, emarginate or mucronate apically, with margins flat or slightly recurved, glabrous throughout or with occasional scattered appressed hairs on the lower surface, with venation semicraspedodromous; petiole 1.5–4.5 mm long, glabrous. Stipules 1–3 mm long, (0.4–) 0.7–1.0 mm wide, usually shorter than the petiole, ovate or narrowly ovate, often oblique and asymmetric basally, longitudinally striate, usually glabrous apart from marginal cilia and scattered hairs towards the apex, sometimes the opposing stipules laterally confluent for much of their length, persistent. Flowers solitary or paired at the nodes, the pedicels (3–) 5–10 mm long, glabrous or sometimes sparingly pubescent; bract solitary, narrow-ovate, 1–2 mm long, 0.6–1.2 mm wide, scarious, glabrous or with marginal cilia, or with hairs along the midline, longitudinally striate, usually rapidly caducous and only visible in young bud; bracteoles narrow-elliptic, 1.3–2.5 (–3.5) mm long, 0.8–1.2 mm wide, scarious, glabrous or with marginal cilia, often inserted above the middle of the pedicel, rapidly caducous and leaving two prominent scars, only visible in young bud. Calyx glabrous

externally or sparingly pubescent especially towards the apices of the lobes, upper surface and two upper lobes red, otherwise green except for tips of the three lower lobes; 2 upper lobes rounded-truncate, 1.2–2.0 mm long excluding the tube 2–4 mm long, the apices of the lobes diverging, acute, with 3 lower lobes 1.2–2.0 mm long, acute or acuminate, shorter than the tube. Standard 9.5–12.2 mm long including a claw 3.5–4.2 mm long, 8.6–11.7 mm wide, longer than the keel, deep yellow-orange internally with a deep purplish-red or reddish-pink basal horseshoe-shaped flare around a yellow throat, externally deep brick-red or purplish-red with yellow or white striations radiating out from the base, sometimes appearing somewhat marbled; wings 8.1–9.0 mm long including a claw 3.2–3.5 mm long, 2.3–2.5 mm wide, externally reddish-pink; keel 7.2–7.5 mm long including a claw 3.2–3.7 mm long, 2.5–3.0 mm wide, externally green basally, dark red apically, densely pubescent or woolly apically in the sinus. Stamen-filaments 6.2–8.7 mm long. Ovary 5.0–6.8 mm long, stipitate, (5–) 7–10-ovulate, glabrous. Pods oblong, (2.0–) 2.5–3.8 cm long, 0.6–0.7 cm wide, the stipe usually exceeding the calyx, with valves thin, inconspicuously transversely venose, glabrous. Seeds ellipsoid, 2.3–2.5 mm long, 1.4–1.7 mm wide, uniformly reddish-brown (Fig. 38).

Distribution and habitat: Occurs in the Darling and Eyre Botanical Districts of the Southwestern Botanical Province from Roleystone on the Canning River south-east of Perth south to Augusta and eastwards to near Albany with an outlier at Phillips River (Fig. 37). *G.F. Craig 2985* (CANB, MEL, PERTH), collected in 1993 at Phillips River confirms the earlier reported nineteenth century occurrence (Ross, 1994b) of *B. rufa* at this locality. Favours moist situations in sandy, alluvial or peaty soils or amongst rocks along stream banks and near swamps. Flowers chiefly Nov.–Dec.

Representative specimens (51 examined): Serpentine River, 1 Dec.1877, *F. Mueller s.n.* (MEL *563561*); Canning River, Croydon Rd, Roleystone, 8 Oct.1967, *G. Heinsohn 147* (PERTH); St John Brook at Cambray, 26 Nov.1975, *A.S. George 14224* (PERTH); Frankland River bridge, 16 Nov.1978, *E. Wittwer 2241* (PERTH); on Alamo Creek, Conveyor Belt route crossing, Bell Block, 29 Aug.1980, *A.S.Weston 12635* (PERTH); 6 km SE of Donnelly River Mill, 14 Dec.1980, *G.J. Keighery 3650* (PERTH); Glenoran Pool, Donnelly River near One Tree Bridge, c. 20 km W. of Manjimup along Graphite Rd, 10 Jan.1993, *T.D. Macfarlane 2140* (MEL, PERTH); Phillips River, S of West River tributary, Fitzgerald River National Park, 29 Sept.1993, *G.F. Craig 2985* (CANB, MEL, PERTH).

Conservation status: Not threatened currently.

Notes: *Bossiaea rufa* and *B. praetermissa* are superficially very similar and have long been confused. *B. praetermissa* differs from *B. rufa* in that the paired bracteoles on the pedicels persist and are present even when the young fruits are developing in contrast to *B. rufa* where the bracteoles are rapidly caducous and visible only when the flower-buds are young. On leafless shoots of *B. praetermissa* a linear terete or subterete appendage is frequently present between the paired stipules at each node which gives rise to the distinctive 'trifid' arrangement, a feature that distinguishes the species from *B. rufa* which lacks this character. In addition, there are a number of other differential tendencies. In *B. rufa* the pedicels tend to be longer, the nature of the indumentum on the calyx, when present, differs, the stipules tend to be larger and more conspicuously longitudinally striate, the standard petals tend to be larger, and the keel petals are invariably densely woolly-pubescent apically. *B. rufa* tends to be a more robust plant and favour moister sites than *B. praetermissa* and the leaves tend to be more numerous and longer. The differences between *B. rufa* and *B. barrettiorum* are given under the latter.

Flowering time in the two species appears to differ. *Bossiaea praetermissa* usually flowers during September and October although flowering specimens have been collected as early as April and as late as early November, whereas *B. rufa* usually flowers in November and December.

When typifying *B. rufa* (Ross, 1994b), it was indicated that the R. Brown specimen in PERTH from King George's Sound, Dec. 1801-Jan.1802, named *B. rufa* consisted entirely of material of *B. praetermissa*. This is the case. However, I discovered subsequently that there is a second sheet of R. Brown material in PERTH from the same locality bearing the manuscript name 'B. purpuraseens'. This latter sheet is referable to *B. rufa* and is treated here as an isolectotype of *B. rufa*.

The distributions of *B. rufa* and *B. praetermissa* overlap in the south-west from approximately Scott River to Albany.

27. *Bossiaea praetermissa* J.H.Ross, *Muelleria* 8: 216 (1994). *Type*: Western Australia, Darling Distr., Albany, hillside above Middleton Beach, 18 Oct.1985, *M.G. Corrick* 9689; holo.: MEL *677843*; iso.: K, PERTH.

Bossiaea rufa sensu Maund, *Botanist* 2: t.81 (1838), non R.Br. (1812).

Bossiaea ensata sensu Meisn. in J.G.C.Lehmann, *Pl. Preiss.* 1: 81 (1844), non Sieb. ex DC. (1825).

Lax many-stemmed shrub to 1 m high, stems weak, prostrate or straggling and often supported by surrounding vegetation, flattened, winged, 1.5–7.0 mm wide, incised at the nodes, glabrous or sparingly clothed with appressed antrorse hairs especially when young or occasionally the hairs spreading and up to 0.25 mm long. Leaves present or absent, when present usually confined to the young growth, alternate, unifoliolate; lamina rotund, obovate, or obovate- to elliptic-oblong, 6–18 mm long, (3.5–) 6.0–10.0 (–12.0) mm wide, rounded, obtuse, emarginate or slightly mucronate apically, glabrous throughout or with scattered appressed hairs on the lower surface especially basally, with venation simple craspedodromous or semicraspedodromous; in the absence of a lamina a linear terete or subterete appendage persists between the two adjacent stipules giving rise to a distinctive 'trifid' arrangement; petiole 1–3.5 mm long, glabrous or with scattered hairs. Stipules narrowly triangular or triangular, 0.7–2.5 mm long, 0.2–0.5 mm wide, usually shorter than the petiole, sometimes oblique basally, usually glabrous apart from apical or marginal cilia, not or inconspicuously longitudinally striate, persistent. Flowers solitary, paired or occasionally pseudoracemose at the nodes, the pedicels 2–5 mm long, clothed with short spreading hairs; bract solitary, ovate or oblong, 0.7–1.5 mm long, 0.4–1 mm wide, inconspicuously longitudinally striate, usually pubescent at least apically and with marginal cilia or hairs along the midline, often pinkish-red, persistent; bracteoles oblong, 0.6–1.75 mm long, 0.2–0.5 mm wide, inserted towards the middle of the pedicel, often pinkish-red, margins ciliate, inconspicuously longitudinally striate, persistent at least until the young fruits develop. Calyx usually densely clothed with short spreading hairs externally but sometimes the hairs very sparse, often pinkish-red; 2 upper lobes rounded-truncate, the apices of the lobes diverging, acute, 1.0–1.8 mm long excluding the tube 2.3–3.6 mm long, with 3 lower lobes 1.0–1.5 mm long, acute, shorter than the tube. Standard 7.5–9.5 mm long including a claw 3.5–4.5 mm long, 7–9 mm wide, longer than the keel, deep yellow internally with a deep purplish-red or brown horseshoe-shaped basal flare around a yellow throat, externally yellow with maroon, red or pale striations radiating out from the base, sometimes appearing somewhat marbled; wings 6.5–8.3 mm long including a claw 3.0–3.5 mm long, 1.5–2.8 mm wide, externally reddish or maroon; keel 6.4–7.8 mm long including a claw 3.0–3.7

Figure 35. Photographs of a, *Bossiaea flexuosa*; b, *B. saxosa*; c, *B. simulata*; d, *B. leptacantha*; e, *B. oxyclada*. Photographs by Barbara Archer.

Figure 36. *Bossiaea eremaea* – a, flowering twig, × 1; b, young leafy twig, × 1; c, calyx opened out (upper lobes on right), × 4; d, standard, × 4; e, wing petal, × 4; f, keel petal, × 4; g, gynoecium, × 4; h, fruiting twig, × 1. a, c–g from *Ross 4004*; b from *Ross 4008*, h from *Ross 4009*.

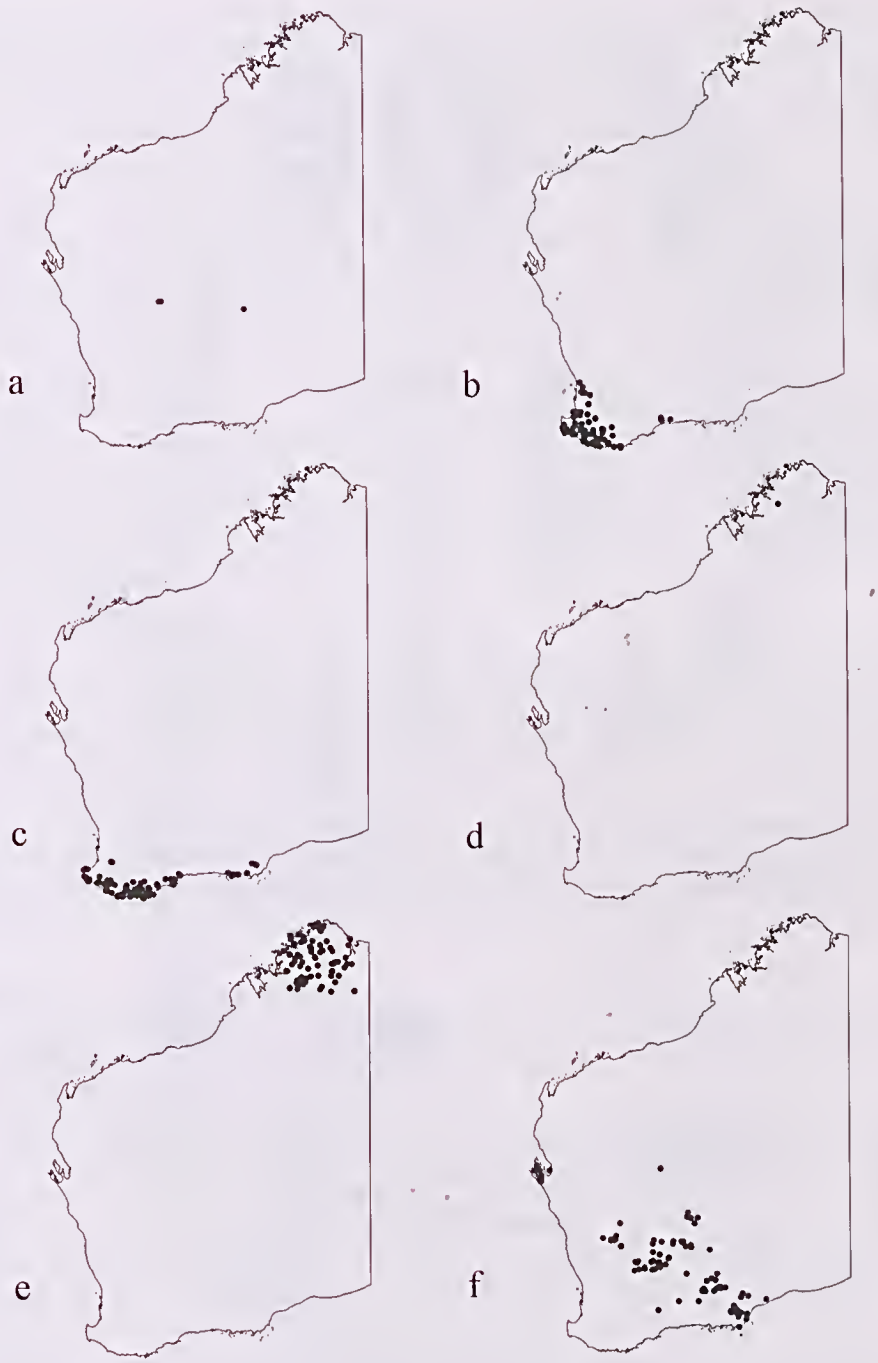

Figure 37. Distributions of a, *Bossiaea eremaea*; b, *B. rufa*; c, *B. praetermissa*; d, *B. barrettiorum*; e, *B. bossiaeoides*; f, *B. walkeri*.

Figure 38. *Bossiaea rufa* – a, flowering and fruiting twig, × 1; b, pedicel showing the prominent scars that mark the points of attachment of the caducous bracteoles above the middle of the pedicel, × 4; c, keel petals, × 4; d, apex of keel petals enlarged to show the dense woolly indumentum, × 8; e, seed, hilar view, × 10; f, seed, lateral view, × 10. *B. praetermissa* – g, flowering twig, × 1; h, pedicel showing persistent bracteoles, × 4. a–f from *Corrick 11029*; g and h from *Corrick 9527*.

mm long, 2.2–3.0 mm wide, externally reddish, usually glabrous apically but sometimes sparingly ciliate or pubescent in the sinus. Stamen-filaments 5.5–8.2 mm long. Ovary 5.0–6.1 mm long, stipitate, 7- or 8-ovulate, glabrous. Pods oblong, 2.0–2.5 cm long, 0.5–0.6 cm wide, the stipe shorter than to as long as the calyx, with valves thin, inconspicuously transversely venose, glabrous. Seeds ellipsoid, 2.1–2.4 mm long, 1.3–1.4 mm wide, uniformly reddish-brown or sometimes mottled (Figs 34a, 38).

Distribution and habitat: Occurs in the Darling and Eyre Botanical Districts of the Southwestern Botanical Province from near Yallingup west of Busselton to Mt Ragged north-east of Esperance (Fig. 37). Found most commonly in sandy soils in coastal heath but also recorded in peaty or sandy clay on the margins of swamps, in mallee and jarrah woodland, on limestone rises and on granitic ridges. Flowers chiefly Sept.–Oct.

Representative specimens (49 examined): 16 km E of Manjimup, 24 Oct.1947, *R.D. Royce 2358* (PERTH); near Bremer Bay, 27 Oct.1965, *A.S. George 6943* (PERTH); Scott River Plains, 1 km N of Brennan's Ford on Courtney Rd, 3 Oct.1982, *G.J. Keighery 5577* (PERTH); Hay River crossing on Albany-Denmark Rd, 19 Sept.1983, *J. Taylor 1965* & *P. Ollerenshaw* (CANB, MEL); Cape Le Grande National Park, Rossiter Bay, 24 Sept.1985, *M.G. Corrick 9527* (MEL); Salt River Rd., near Camel Lake, Stirling Range, 14 Sept.1987, *G.J. Keighery 9764* (PERTH); 12 km toward Denmark from Muir Highway on Denmark - Mt Barker Rd, 28 Nov.1992, *T.D. Macfarlane 2081* & *H.R. White* (MEL, PERTH).

Conservation status: Not threatened currently.

Notes: When a leaf lamina fails to be produced at a node, its place is taken by a terete or subterete appendage that extends beyond the stipules and persists between the two adjacent stipules giving rise to a distinctive 'trifid' arrangement.

The differences between *B. praetermissa* and *B. barrettiorum* are given under the latter.

In the absence of a preserved specimen, it is difficult to determine whether or not the plant featured under the name *B. rufa* in Lodd., Bot. Cab. 12: t.1119 (1826), is in fact *B. praetermissa* rather than *B. rufa*. It is referred here to *B. praetermissa* with some hesitation.

28. *Bossiaea barrettiorum* J. H. Ross, *sp. nov.*

B. bossiaeoide (A.Cunn. ex Benth.) Court affinis, a qua planta minori diffusa vel semiprostrata, caulibus angustissimus ad 0.85 cm latis, floribus minoribus, petalis carinae et vexilli glabris, differt.

Type: Western Australia, Gardner Distr., 5 km due E of junction of Pitta Creek and Prince Regent River, 11 Jan. 2001, *M.D. Barrett 1195*; holo. PERTH; iso.: MEL *2280352*.

Lax spreading or semi-prostrate shrub to 0.7 m high and 2 m wide, stems oval, elliptic or flattened, winged, almost completely glabrous apart from hairs in the axils of the scale leaves, ultimate branches of cladodes 0.7–8.3 mm wide, winged, incised at the nodes. Leaves reduced to dark brown scarious narrowly ovate scales 0.7–1.6 mm long, glabrous apart from marginal cilia and often with hairs along the midline apically. Flowers solitary or paired at the nodes, the pedicels 3.0–4.5 mm long, glabrous; bracts imbricate, narrow-ovate, increasing in size from the outer to the inner, the inner up to 1.6 mm long and similar to the bracteoles, inconspicuously longitudinally striate, glabrous apart from marginal hairs especially towards the apex and sometimes along the midline apically, chestnut brown, persisting at least until the young pods start developing; bracteoles narrow-ovate, 1.1–1.6 mm long, inserted at about the middle of

the pedicel, glabrous apart from marginal cilia especially towards the apex and sometimes with hairs apically along the midline, inconspicuously longitudinally striate, persistent at least until the young fruits develop. Calyx glabrous externally apart from hairs on the margins of the lobes, apparently suffused with pink or red; 2 upper lobes rounded-truncate, the apices of the lobes diverging, acute, 2.3 mm long excluding the tube 3.1 mm long, with 3 lower lobes 1.3 mm long, acute, shorter than the tube. Standard 9.2 mm long including a claw 2.9 mm long, 8.5 mm wide, shorter than the keel, deep yellow internally with a faint discontinuous red horseshoe-shaped basal flare around a paler yellow throat, externally yellow with faint red longitudinal striations radiating from the base into the lamina; wings 8.0 mm long including a claw 2.1 mm long, 1.7–1.8 mm wide, distinctly auricled basally, uniformly yellow, glabrous; keel 9.6 mm long including a claw 2.8 mm long, 3.8 mm wide, externally yellow or greenish-yellow, glabrous apically in the sinus. Stamen-filaments 6.7–8.0 mm long. Ovary 7–9 mm long, on a stipe up to 1.3 mm long, 11-ovulate, glabrous; style 2 mm long. Pods oblong, 2.7–4.8 cm long, 0.65–0.8 cm wide, the stipe exceeding the calyx, with valves inconspicuously transversely venose, glabrous, dark reddish- brown when mature. Seeds ellipsoid, 3.5–3.9 mm long, 2.0–2.4 mm wide, chestnut-brown with subtle darker mottles (Fig. 39).

Distribution and habitat: Known only from two populations on the summit of a single sandstone massif north of the Prince Regent River (M. Barrett, pers. comm.) in the Gardner Botanical District of the Northern Botanical Province (Fig. 37). Occurs in shallow sand amongst rocks with *Triodia* sp. at the base of a low sandstone ridge on the summit of the sandstone massif. Flowers December–January.

Conservation status: CALM Conservation Code for Western Australa: Priority One. Possibly not at risk because of its remote isolated location but known from only two populations about 2 km apart.

Notes: I have had access only to the type collection and the above description is based on that collection alone. *Bossiaea barrettiorum* differs from *B. bossiaeoides*, the only other *Bossiaea* species in the Kimberley, in being a much smaller spreading or semi-prostrate shrub with much narrower cladodes, and in having smaller flowers with glabrous standard and keel petals. *Bossiaea bossiaeoides* has been recorded flowering during most months of the year. It is not known whether *B. barrettiorum* does likewise.

Superficially reminiscent of *B. praetermissa* and *B. rufa* which occur on the south coast in the Southwestern Botanical Province thousands of kilometres away. *Bossiaea praetermissa* differs in having pubescent pedicels and calyces, differently coloured corollas and stipulate leaves, whereas *B. rufa* has caducous bracteoles, differently coloured corollas and keel petals that are densely pubescent or woolly apically in the sinus.

Etymology: The species is named in honour of Matthew and Russell Barrett who discovered it, along with several other novelties, during field work in the Kimberleys conducted in the wet season.

29. *Bossiaea bossiaeoides* (A.Cunn. ex Benth.) Court, *Muelleria* 2: 139 (1971). *Acacia bossiaeoides* A. Cunn. ex Benth. in Hook., *Lond. J. Bot.* 1: 323 (1842). *Type*: 'Liverpool Range, N. Coast, [Northern Territory], A. Cunningham.'; lecto.: K.

Bossiaea phylloclada F. Muell., *Trans. Phil. Inst. Victoria* 3: 52 (1859). *Type*: 'on the edges of the sandstone tableland, and on stony declivities, and barren bushy

undulations of Arnhem's Land.', Northern Territory, *F. Mueller* ['In rupibus ad fluv. Fitzmaurice. Oct. 1855']; lecto.: K.

Much-branched shrub to 3 m high, almost completely glabrous except for hairs in the axils of the scales leaves, glaucous or green except during the dry season when yellowish, young growth reddish; branches often somewhat flexuose, oval or flattened and very broadly winged, ultimate branches of cladodes 10–65 mm wide, wings incised at the nodes, the lobes projecting laterally or forwards and usually with an acute or distinctly pungent apex, often with a white waxy layer that exfoliates, conspicuously venose, the margin thickened. Leaves reduced to brown scarious longitudinally striate narrowly ovate or ovate scales 2.5–5.0 mm long, persistent. Flowers solitary or in fascicles of 2–6 per node, the pedicels 4–10 mm long, glabrous or almost so; bracts increasing in size from the outer to the inner, ovate, 0.7–2.2 mm long, scarious, longitudinally striate, with margins ciliate, persistent; bracteoles ovate, 0.7–2.0 mm long, the margins ciliate or glabrous apart from hairs near the apex, longitudinally striate, often inserted near the middle of the pedicel, persisting at least until the young pods develop. Calyx glabrous externally apart from hairs on the margins of the lobes, greenish; with 2 upper lobes rounded-truncate, considerably enlarged and broader relative to the lower three, 3.0–3.5 (–5.0) mm long excluding the tube (3.0–) 4.0–7.5 mm long, with 3 lower lobes 1.7–2.5 mm long, triangular, acute, shorter than the tube. Standard 15–19 mm long including a claw 4.5–6.6 mm long, 13.5–17.0 mm wide, often shorter than the keel, emarginate, yellow throughout or sometimes suffused with orange or red internally, often with marginal hairs towards the apex and in the sinus; wings 12–18 mm long including a claw 3.5–5.3 mm long, 4.0–5.6 mm wide, shorter than the keel, auricled, externally yellow; keel 12–20 mm long including a claw 4.6–5.0 mm long, 6.5–7.5 mm wide, auricled, externally yellow or orange, sparingly to densely woolly-pubescent on the margin apically and in the sinus. Ovary 7.0–9.5 mm long, on a stipe 2.5–6.0 mm long, 8 (–12)-ovulate, glabrous throughout; style 4.0–6.5 mm long. Pods oblong, 3.5–5.5 cm long, 0.7–1.2 cm wide, the stipe greatly exceeding the calyx, with valves conspicuously transversely venose, glabrous, dark reddish-brown when mature ultimately turning blackish, margins thickened. Seeds c. ellipsoid, 3.7–4.5 mm long, 2.0–2.6 mm wide, olive to chestnut-brown with dark purplish mottles (Fig. 39).

Distribution and habitat: Widespread across tropical Australia N of 18°S from islands off the NW coast of W.A., the N.T. and islands of the Gulf of Carpentaria, to Westmoreland Station in NW Queensland (Fig. 37). Occurs in open woodland or low scrub, often in creek beds or on creek banks, usually associated with sandstone or coarse well-drained sandy or lateritic soils. Flowers most months of the year.

Specimens examined (78): Prince Regent River Reserve, 14 Aug.1974, *K.F. Kenneally 3063* (PERTH). Drysdale River National Park, Dromains Ck, near S end of Ashton Ra., 3 Aug.1975, *A.S. George 13201* (PERTH). 27 km N of Kalumburu Mission, 14 May1983, *P.A. Fryxell & L.A. Craven 4109* (CANB, MEL, NY, PERTH). Beverley Springs Stn, 1 May1988, *R.J. Cranfield 6636* (PERTH). East Kimberley, Osmond Valley Stn, 18 Nov.1989, *K.A. Menkhorst 757* (CANB, DNA, MEL, PERTH).

Conservation status: Not threatened currently.

Notes: The broadly winged cladodes distinguish *B. bossiaeoides* at once from the other leafless species. *B. bossiaeoides* is unusual in that the standard often has hairs on the margins towards the apex and in the sinus.

The differences between *B. barrettiorum* and *B. bossiaeoides*, the only other *Bossiaea* species occurring in the Kimberley, are given under the former. There is a report (R. Barrett, pers. comm.) of a form of *B. bossiaeoides* from fire-protected sites on

Mt Bonford across to Mt Fyfe north of the Prince Regent River in the Kimberley in which the wings on the cladodes do not exceed the nodes. I have not seen a specimen but the taxonomic significance, if any, requires investigation.

During the dry season plants lose condition and often assume a yellowish hue, but green-up again once the rains commence in a manner reminiscent of resurrection plants (C. Dunlop, pers. comm.).

30. *Bossiaea walkeri* F. Muell., *Fragm.* 2: 120 (1861); Benth., *Fl. Austral.* 2: 167 (1864). *Type*: 'In pinetis montium Peel Range [now Coeoparra Range], inter flumina Lachlan et Murrumbidgee. Alex Walker.'; New South Wales, 10 Nov. 1860, *A. Walker s.n.* lecto.: MEL *20337* (here selected).

Rigid much-branched shrub to 2.5 m high and 3 m wide, almost completely glabrous except for hairs in the axils of the scale leaves and sometimes the young growth sparingly pubescent, especially on the margins of the cladodes; branches terete to oval or slightly flattened, ultimate branches of cladodes 3–8 mm wide, winged, notched at the nodes, sometimes terminating in a pungent point but more often apex blunt, often with a white waxy surface that exfoliates when the branches dry. Leaves reduced to broadly ovate dark brown scales 1.1–2.1 mm long, 1.0–1.8 mm wide, longitudinally striate, glabrous except for marginal cilia and often with hairs along the midline, persistent. Flowers solitary at the nodes, pendulous, the pedicels up to 5 mm long, glabrous throughout; bracts imbricate, broadly ovate, increasing in size from the outer to the inner, the uppermost 1.8–3.0 mm long, 1.8–2.4 mm wide, with conspicuous marginal cilia and often with a row of appressed hairs along the midline, longitudinally striate, persistent; bracteoles broadly ovate or obovate, 2.3–3.5 mm long, inserted just above the bracts, brown, longitudinally striate, ciliate on margins, rapidly caducous but leaving distinct scars. Calyx uniformly greenish-yellow or green suffused with red or brown, glabrous externally apart from hairs on the margins of the lobes; 2 upper lobes rounded-truncate, much broader than the lower three, 2.3–5.5 mm long excluding the tube 3.5–6.0 mm long, with 3 lower lobes 1.9–3.9 mm long, shorter than the tube, acute. Standard much shorter than the keel, 18–19 mm long including a claw 5.0–5.5 mm long, 16.5–17.5 mm wide, externally usually more or less uniformly red or salmon pink (rarely yellow) or occasionally suffused with orange, sometimes burgundy basally; wings 15.8–18.0 mm long including a claw 3.5–4.0 mm long, 2.8–3.7 mm wide, usually uniformly salmon-pink, externally sometimes with a distinct yellow margin; keel 19.0–23.6 mm long including a claw 3.0–3.5 mm long, 5.0–5.5 mm wide, externally often deep red or burgundy, glabrous or with scattered hairs in the sinus but apices of lobes not densely woolly-pubescent. Stamen-filaments 15–24 mm long. Ovary 7.5–11.0 mm long, on a stipe up to 4.2 mm long, 12–20-ovulate, glabrous throughout or sparingly to densely clothed with scattered hairs on the margins; style 6.0–9.5 mm long. Pods oblong, (2.5–) 4.5–7.0 cm long, 0.7–1.1 (–1.3) cm wide, stipe about as long as the calyx-tube but shorter than the upper lobes, with valves conspicuously transversely venose, glabrous or with scattered hairs along the upper or both sutures and occasionally with a few hairs on the valves. Seed 3.1–4.0 mm long, 2.1–2.5 mm wide, uniformly olive-brown or with black or purplish mottles on an olive- to yellowish-brown background (Fig. 34d).

Distribution and habitat: Widespread across southern mainland Australia from Dorre Is off the coast of Shark Bay in Western Australia, to southern South Australia, western New South Wales and north-west Victoria (Fig. 37). Frequently associated with mallee communities or low open woodland and found in deep sand, on dunes, in sandy-

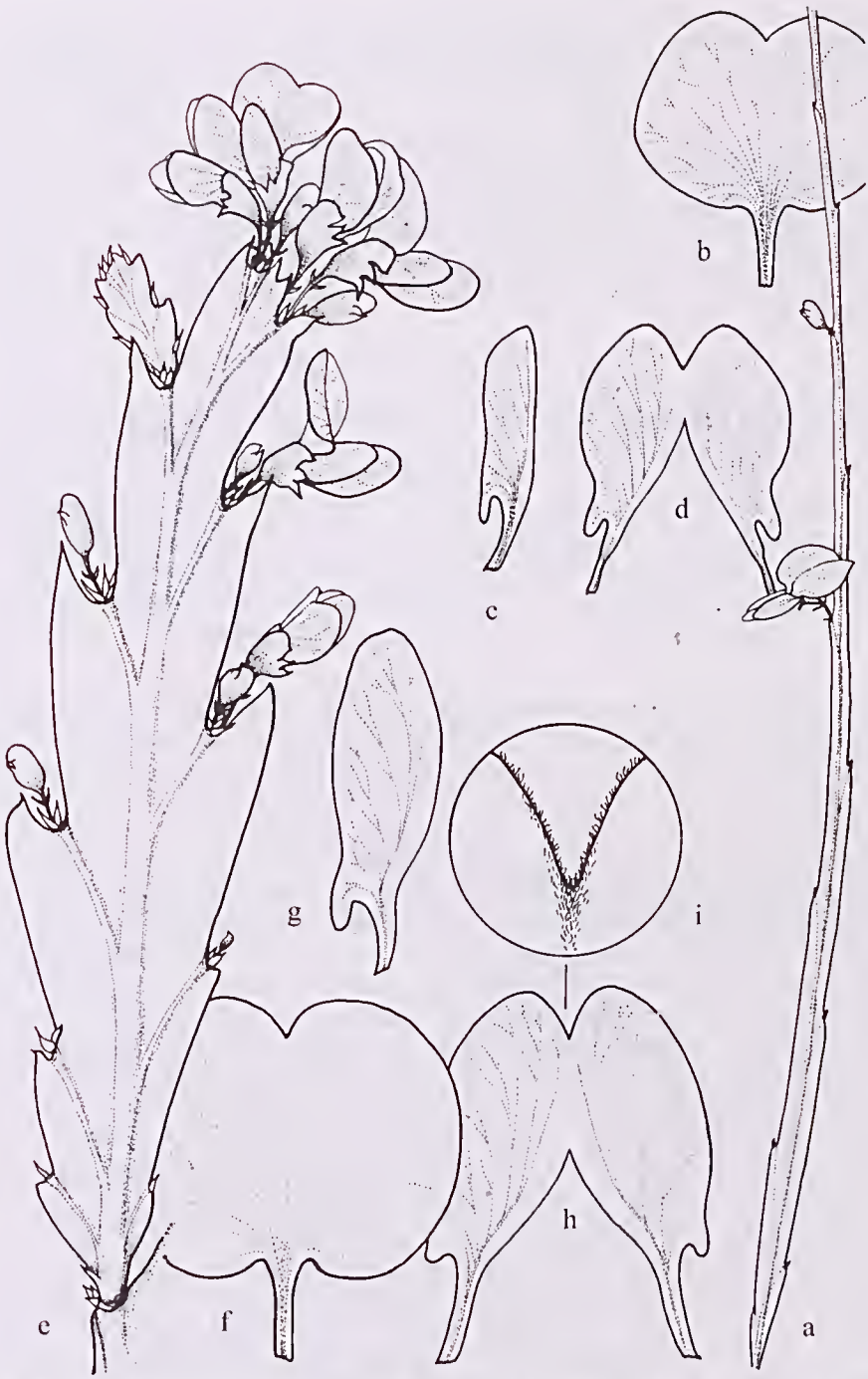

Figure 39. *Bossiaea barrettiorum* – a, flowering twig, × 1; b, standard, × 4; e, wing, × 4; d, keel petals, × 4. *Bossiaea bossiaeoides* – e, flowering twig, ×1; f, standard, × 3; g, wing, × 3; h, keel petals, × 3; i, apex of keel petals enlarged to show woolly pubeseenee on the margin and in the sinus, × 5. a–d from *R. Barrett 1195*; e–i from *Carr 4105 & Beauglehole 47883*.

Figure 40. Distributions of a, *Bossiaea cucullata*; b, *B. leptacantha*; c, *B. halophila*; d, *B. oxyclada*; e, *B. saxosa*; f, *B. flexuosa*.

or clay-loam, in creek beds and on rocky outcrops. Not usually associated with salt lakes but occasionally found on high ground on the perimeter of a salt lake or on raised islands in salt lakes. Flowers usually late July–Nov., although sometimes in autumn (May) in New South Wales.

Representative specimens (132 specimens examined): 36.8 km [23 miles] NE of Southern Cross, 5 Sept.1966, *K. Newby 2532* (PERTH). 4.8 km [3 miles] NE of Tamala Stn H.S., 27 Aug.1969, *A.S. George 9566* (MEL, PERTH). Dorre Is., 20 June 1974, *K.F. Kenneally s.n.* (PERTH *01011111*). 22 km WSW of Mt Pleasant, 5 Oct.1980, *K. Newby 7756* (PERTH). Mt Jackson, 25 Sept.1986, *B.H. Smith 757* (CANB, MEL, PERTH). 5 km S of Balladonia Roadhouse on Balladonia Roadhouse-Mt Ragged Rd, 3 Aug.1995, *B. Archer 23* (AD, BRI, HO, K, MEL, NSW, PERTH).

Conservation status: Not threatened currently.

Notes: The most widely distributed of the leafless species of *Bossiaea* in Australia. The differences between *B. walkeri* and *B. cucullata*, the only two leafless species with large pendulous flowers, are discussed under the latter.

The pendulous nature of the flowers, the reduced size of the standard relative to the keel petals, and the large elongated keel petals suggest that *B. walkeri* is pollinated by birds. The notes accompanying *B. Archer 780* (MEL) record Singing Honeyeaters, Spiny-Cheeked Honeyeaters and Blue-Breasted Fairy Wrens visiting flowering plants.

The seeds of *B. walkeri* are rather small in relation to the size of the pods.

31. *Bossiaea cucullata* J.H.Ross, *Muelleria* 11: 8 (1998). *Type:* Western Australia, Roe Distr., western shore of Lake King, 14 Oct.1997, *B. Archer 840*; holo.: MEL *2044725*; iso.: K, PERTH.

Bossiaea sp. sensu Corrick & Fuhrer, Wildflowers of southern Western Australia 56, pl. 129 (1996).

Rigid dense multi-stemmed much-branched grey-green shrub to 2 m high and 5 m wide, almost completely glabrous except for hairs in the axils of the scale leaves and the young growth sparingly to densely clothed with appressed hairs; branches terete to oval or slightly flattened, ultimate branches of cladodes 2–5 mm wide, narrowly winged, notched at the nodes, sometimes terminating in a pungent point, usually with a white waxy surface that exfoliates when the branches dry. Leaves reduced to dark brown ovate scales 0.7–1.5 mm long, the scales sometime splitting apically into two lobes, with marginal cilia and hairs externally especially along the midline, persistent. Flowers solitary at the nodes or rarely paired, pendulous, the pedicels up to 5 mm long, usually glabrous above the bracteoles and sparingly to densely clothed with appressed hairs below; bracts imbricate, brown, broadly ovate, increasing in size from the outer to the inner, the uppermost 0.9–1.1 mm long, 0.6–0.8 mm wide, appressed to the pedicel, often some distance above the other bracts, similar to the bracteoles, with conspicuous marginal cilia and appressed hairs externally, persistent; bracteoles broadly ovate 1.0–1.2 mm long, 0.7–0.9 mm wide, inserted towards the middle of the pedicel, brown, with marginal cilia and scattered appressed hairs externally especially towards the apex, persisting until the pods mature. Calyx green suffused with purplish-brown on the adaxial surface, glabrous externally apart from hairs on the margins of the lobes, pubescent internally; 2 upper lobes very much larger than the lower three and longer than the tube, 4.9–10.2 mm long excluding the tube 2.3–4.4 mm long, rounded, lobes acute, with 3 lower lobes 1.1–2.4 mm long, shorter than the tube, acute to acuminate, somewhat recurved apically. Standard much shorter than the keel, 10.0–14.4 mm long including a claw 2.5–5.0 mm long, 10.0–15.5 mm wide, externally usually deep yellow

or orange-yellow and sometimes suffused with dark red or purple apically, sometimes uniformly pale yellow throughout; wings about the same length as the standard but much shorter than the keel, 10.5–15.0 mm long including a claw 2.5–4.0 mm long, 1.8–3.0 mm wide, externally typically the same colour as standard; keel 13.5–26.0 mm long including a claw 2.5–4.0 mm long, 3.5–8.0 mm wide, externally deep red, burgundy, maroon or pale greenish-yellow throughout or suffused with red on the margins and apically. Stamen-filaments 11.5–29.0 mm long. Ovary 5–15 mm long, on a stipe 3–5 mm long, 10–18-ovulate, glabrous; style 6.0–10.2 mm long. Pods oblong, 2.5–4.8 cm long, 0.5–0.7 cm wide, stipe about as long as the calyx-tube but much shorter than the upper lobes, with valves not conspicuously transversely venose, pale brown or greenish-brown and often suffused with pink, glabrous. Seed elliptic-oblong, 2.6–4.1 mm long, 1.9–2.6 mm wide, with black mottles on a yellow or olive background, seldom uniformly yellow or olive (Fig. 34e).

Distribution and habitat: Known from Lake Derdibin and Lake King in the Avon and Roe Botanical Districts respectively of the Southwestern Botanical Province and from Lake Johnston, an unnamed salt lake system NW of Norseman on the old Norseman–Hyden road, Lake Gilmour and the eastern shore of Lake Cowan in the Coolgardie Botanical District of the Southwestern Interzone (Fig. 40). Favours deep sand around the perimeter of salt lakes and often occurs in large populations. Very large disjunctions separate several of the populations. Flowers Sept.–early Dec.

Representative specimens (45 specimens examined): Lake Derdibin, 21 Feb.1992, *B.H. Smith 1641* (MEL, PERTH); 13 Oct.1993, *B.H. Smith 1703* (MEL, PERTH). western edge of Lake King, 7 Sept.1986, *P.S. Short 2747* (CANB, MEL, PERTH); 24 Sept.1996, *M.G. Corrick 11227* (MEL). Norseman-Hyden Tk, 29.2 km W of junction of Norseman-Hyden Tk and Coolgardie-Esperance Rd, 8 Oct.1998, *B. Archer 1173* (K, MEL, NSW, PERTH). Lake Gilmour, 52.5 km S of Norseman P.O. on Coolgardie-Esperance Rd, 25 Oct.1998, *B. Archer 1178* (MEL, PERTH). 12.3 km NE of Norseman P.O., eastern shore of Lake Cowan, 11 Mar. 2001, *B. Archer 1870* (MEL, PERTH).

Conservation status: CALM Conservation Code for Western Australian Flora: Priority Four.

Notes: When described, *B. cucullata* was known only from Lake Derdibin and Lake King. Larger populations have been found since much further east at Lake Johnston, around an unnamed salt lake system NW of Norseman and at Lake Gilmour and Lake Cowan. The discovery of the eastern populations suggests that close inspection of the numerous salt lakes between Lake King and Norseman may reveal additional populations.

Superficially similar to *B. walkeri* with which it was initially confused. However, *B. cucullata* differs from *B. walkeri* in having differently coloured flowers; in *B. walkeri* the standard is usually uniformly red or salmon pink (rarely pale yellow) or occasionally suffused with orange or sometimes burgundy basally, whereas in *B. cucullata* the standard is predominantly deep yellow or orange-yellow externally throughout or suffused with dark red or purple apically, or is pale greenish-yellow throughout. In *B. cucullata* the lower three calyx lobes are smaller in relation to the size of the upper lobes than is the case in *B. walkeri*, the bracteoles persist on the pedicel until the pods mature, the bracts and bracteoles are smaller (to 1.2 mm long), the pedicels are pubescent below the point of attachment of the bracteoles, and the pods are usually shorter and narrower. When the keel in *B. cucullata* is deep red, burgundy or maroon, it contrasts strongly with the predominantly yellow or orange-yellow standard.

In contrast to *B. walkeri*, which has a widespread distribution in southern mainland Australia and grows in a variety of habitats, *B. cucullata* is known from only six disjunct localities in Western Australia. The two species do not appear to grow together at any locality.

Mention was made in the protologue of *B. cucullata* of slight differences in flower colour between the Lake Derdibin and Lake King populations, the keel in the former population being maroon in contrast to the red or burgundy found in the Lake King population. Discovery of the eastern populations has introduced an even greater range of variation in flower colour and in flower size. The flowers on some plants in the Lake Gilmour and Lake Cowan populations are uniformly yellow while on others, and on some of the plants in the population NW of Norseman, the keel petals are yellow throughout or tinged with red on the margins and apically rather than deep red, burgundy or maroon as in the Lake Derdibin and Lake King populations. Some of the flowers in the eastern populations tend to be smaller and flowers continue to be produced later in the season than in the western populations. Apart from these differences, the plants in the eastern populations agree in all essential respects with the western populations.

The pendulous tendency of the flowers, the reduced size of the standard and wing petals, and the large, elongated, typically red keel petals suggest that *B. cucullata* is pollinated by birds. Yellow-plumed Honeyeaters have been observed feeding on flowers of *B. cucullata* (B. Archer, pers. comm.).

32. *Bossiaea leptacantha* E. Pritz. in F.L.E.Diels & E.Pritzel, *Bot. Jahrb.* 35: 263 (1904). *Type*: 'in distr. Eyre versus fines boreales pr. Graspatch in fruticetis apertis arenoso-lutosis flor. m. Nov.', *Diels 5293* (B, destroyed). Western Australia, Roe Distr., Ridley Road, 6 km E of Grasspatch, 7 Oct.1997, *B. Archer 810*; neotype: MEL *2044685*, here selected; isoneo: CANB, K, NY, PERTH).

Much-branched low compact spreading shrub to 50 cm high and 1 m wide, usually with many stems arising at ground level from a rootstock or rhizome and lacking a single well-defined aerial stem, almost completely glabrous except for appressed hairs on the very young growth; branches terete to oval or slightly flattened, ultimate branches of cladodes 1.0–1.5 mm wide, scarcely or very narrowly winged, notched at the nodes, often terminating in a pungent point, usually with a white waxy surface that exfoliates when the branches dry. Leaves reduced to dark brown broadly ovate scales 0.7–1.0 mm long, inconspicuously longitudinally striate, glabrous or almost so apart from marginal cilia. Flowers mostly solitary at the nodes, occasionally paired, the pedicels up to 7.5 mm long, glabrous throughout or sometimes sparingly clothed with appressed hairs; bracts imbricate (up to 13), increasing in size from the outer basal bract to the innermost, broadly ovate, the uppermost 0.5–1.0 mm long and up to 1 mm wide, brown, with conspicuous marginal cilia and sometimes with hairs externally towards the apex, not conspicuously longitudinally striate, persistent; bracteoles ovate or obovate, 0.8–1.5 mm long, usually inserted well below the middle of the pedicel but sometimes near the middle, not or scarcely overlapping the base of the calyx, brown, with marginal cilia, persisting at least until the young pods develop. Calyx green suffused with red or brown, or green apart from brown tips to the lobes, or rusty-brown throughout, usually glabrous throughout externally apart from hairs on the margins of the lobes but occasionally with a few scattered hairs especially towards the apices of the lobes; 2 upper lobes rounded-truncate, 1.0–2.4 mm long excluding the tube 1.8–3.5 mm long, acute, with 3 lower lobes 1.3–1.9 mm long, usually shorter than the tube, acute or obtuse. Standard 7.7–9.4 mm long including a claw 2–3 mm long, 8.0–10.2 mm wide,

internally usually deep yellow throughout but sometimes with a basal red flare from which longitudinal red striations radiate into the lamina; wings 6.5–8.5 mm long including a claw 1.8–2.3 mm long, 1.8–3.0 mm wide, deep yellow; keel 6.5–8.2 mm long including a claw 2.0–2.8 mm long, 3.1–3.7 mm wide, pale greenish-yellow, glabrous. Stamen-filaments 5.2–7.8 mm long. Ovary 4.5–6.0 mm long, on a stipe 0.7–2.5 mm long, 8–12-ovulate, glabrous throughout; style 2–3 mm long. Pods oblong, 1.5–2.4 cm long, 0.4–0.6 cm wide, stipe usually about as long as the calyx-tube and shorter than the upper lobes, with valves pale to dark reddish-brown, conspicuously transversely venose, glabrous. Seeds elliptic-oblong, 1.9–3 mm long, 1.3–1.6 mm wide, uniformly olive- or reddish-brown or with purplish mottles (Figs 35d, 41).

Distribution and habitat: Confined to the western portions of the Eyre and Roe Botanical Districts of the Southwestern Botanical Province and southern portion of the Coolgardie Botanical District of the Southwestern Interzone from the vicinity of Peak Charles in the west to Madura in the east (Fig. 40). Favours fine sandy soil, sandy clay or clay loam, often over limestone. Often in open mallee woodland with *Melaleuca*, *Acacia* or *Callitris*. Flowers Sept.–Dec.

Representative specimens (53 specimens examined): 6 km ESE of Mt Ridley, 12 Oct.1991, *W.R. Archer 12109112* (MEL, PERTH). 78 km NE of Condingup, 11 Oct.1996, *B. Archer 399* (AD, MEL, PERTH). 75 km E of Norseman on Eyre Hwy, 4 Oct.1992, *M.G. Corrick 11012* (CANB, MEL, NSW, PERTH). Peak Charles National Park, 21 Sept.1985, *M.G. Corrick 9484* (MEL, PERTH). 30 km NW of Balladonia Motel, Eyre Hwy, 20 Sept.1980, *K. Newby 7542* (PERTH).

Conservation status: widespread and not threatened currently, although increased levels of salinity could pose a threat to the species.

Notes: Among the rigid leafless *Bossiaea* species in southern Western Australia in which the standard petal is held erect like a banner, *B. leptacantha* and *B. oxyclada* are the only two that exhibit a combination of glabrous ovaries, persistent bracteoles, and pedicels that are glabrous or with scattered appressed hairs. *Bossiaea leptacantha* differs from *B. oxyclada* in having narrower terete to oval or slightly flattened ultimate cladodes 1–1.5 mm wide, differently coloured flowers, and a more easterly distribution. In *B. leptacantha* the wings are deep yellow and the keel is pale greenish-yellow in contrast to *B. oxyclada* in which the wings are pinkish-brown and often suffused with yellow apically and the keel is red. *Bossiaea oxyclada* is confined to the Fitzgerald River National Park whereas *B. leptacantha* is widespread from Peak Charles in the west to Madura in the east. A further differential tendency is that *B. leptacantha* tends to grow as a lower more compact shrub with numerous stems arising at ground level from a rootstock or rhizomes and lacks a single well-defined aerial stem.

The differences between *B. leptacantha* and *B. halophila* are given under the latter.

The standard petal is typically deep yellow throughout but variation is encountered in some populations and the standards have a basal red to orange flare. This basal coloured flare may be present in the flowers of up to two-thirds of the plants in some populations.

Occasionally confused with *Templetonia battii* F.Muell. but, apart from obvious differences in the flowers and fruits, the young branchlets of the latter are distinctly longitudinally striate and lack the waxy exfoliating surface typical of *B. leptacantha*.

33. *Bossiaea halophila* J.H.Ross, *Muelleria* 11: 5 (1998). *Type*: Western Australia, Roe Distr., W shore of Lake King, 1 Nov. 1996, *M.G. Corrick 11479*; holo.: MEL *2044714*; iso. CANB, K, NSW, NY, PERTH.

Erect much-branched shrub to 1.4 m high and 2 m wide, almost completely glabrous except for hairs in the axils of the scale leaves and scattered hairs on young growth; branches ascending, flattened or elliptic, ultimate branches of cladodes 0.75–2.2 mm wide, scarcely or narrowly winged, notched at the nodes, sometimes ending in an acute point but scarcely pungent-pointed, longitudinally striate, growth of current season green or greenish-blue but older growth usually with a thin greyish-white waxy surface that exfoliates when the branches dry. Leaves reduced to ovate brown scales 0.8–1.8 mm long, longitudinally striate, pubescent apically, persistent. Flowers usually solitary at the nodes but sometimes pseudoracemose, the pedicels 6–8 mm long, glabrous throughout or with scattered appressed hairs; bracts imbricate, ovate, increasing in size from the outer basal bract to the innermost, the uppermost 0.7–1.2 mm long, brown, with conspicuous marginal cilia, soon caducous but the basal bracts persisting; bracteoles narrow-elliptic, 1.0–2.3 mm long, usually inserted above the middle of the pedicel, overlapping the base of the calyx in bud but rapidly caducous, scarious, longitudinally striate, with marginal cilia, the cilia prominent apically. Calyx green but the upper lobes suffused with pink or red and the median line darker, usually glabrous throughout externally apart from hairs on the margins of the lobes but occasionally with a few scattered appressed hairs towards the apices of the lobes or sometimes throughout; 2 upper lobes 1.4–1.9 mm long excluding the tube 3.3–4.6 mm long, with 3 lower lobes 1.1–2.0 mm long, shorter than the tube, acute. Standard about as long as or slightly longer than the keel, 10.0–13.5 mm long including a claw 2.0–5.5 mm long, 8.8–9.5 mm wide, yellow internally with a reddish-brown throat from which numerous reddish-brown longitudinal striations radiate into the lamina, yellow externally apart from the reddish-brown base from which reddish-brown longitudinal striations radiate into the lamina; wings about as long as the keel, 9.0–10.5 mm long including a claw 2.5–3.8 mm long, 1.9–2.8 mm wide, yellow throughout or with a longitudinal reddish-brown striation externally towards the lower margin and almost parallel to it; keel 9.5–10.6 mm long including a claw 3–4 mm long, 3.5–4.2 mm wide, pale greenish-yellow throughout or sometimes with a red-brown longitudinal striation externally towards the lower margin and more or less parallel to it, with woolly hairs apically in the sinus. Stamen-filaments 7.2–10.8 mm long. Ovary 5–7 mm long, on a stipe 1.2–3.2 mm long, 6–10-ovulate, glabrous apart from hairs on the lower suture; style 2.4–4.0 mm long. Pods oblong, 1.3–3.0 cm long, 0.4–0.6 cm wide, stipe about as long as the calyx-tube and not exceeding the upper lobes, with valves pale chestnut- or pinkish-brown, transverse venation not conspicuous, with appressed hairs on the margins when young but glabrescent. Seeds elliptic-oblong, 2.6–3.4 mm long, 1.6–2.3 mm wide, a uniform pale fawn (Fig. 34b).

Distribution and habitat: Occurs in the Roe Botanical District of the Southwestern Botanical Province where it is recorded from the vicinity of Pingaring to SE of Hyden in the north southwards to Lake Chinocup and the vicinity of Pingrup in the west with an outlying population at Lake King (Fig. 40). Favours well drained deep sand around salt lake systems. Often in association with mallee eucalypts, *Melaleuca* spp., and Chenopodiaceae, sometimes also with *Santalum acuminatum* and *Scaevola spinescens* R.Br. Recorded flowering in May, Sept.–early Nov.

Figure 41. *Bossiaea leptacantha* – a, flowering twig, × 1; b, calyx opened out (upper lobes on right) and showing pedicel with basal imbricate bracts and paired bracteoles attached near the middle, × 4; c, standard, × 4; d, wing petal, × 4; e, keel petal, × 4; f, fruiting twig, × 1; g, seed, hilar view, × 10; h, seed, lateral view, × 10. a–e from *B. Archer 800*; f–h from *B. Archer 858*.

Representative specimens (14 examined): Pingrup, Oct.1933, *W.E. Blackall 3097* (PERTH). 10km W of Pingaring, 12 Oct.1977, *G.J. Keighery 1104* (PERTH). 10.6 km SE of Hyden on Hyden-Varley Rd., 27 Nov.1996, *J.H. Ross* 3862 (MEL, PERTH). W. shore of Lake Grace, 8.6 km W of Lake Grace Post Office on Lake Grace-Kukerin Rd, 28 Nov.1996, *J.H. Ross 3873* (MEL, PERTH).

Conservation status: CALM Conservation Code for Western Australian Flora: Priority Three. Increased levels of salinity will threaten this species.

Notes: Bossiaea halophila differs from *B. leptacantha* in being a much larger erect shrub with ascending branches arising from an aerial stem (*B. leptacantha* grows as a low spreading shrub with stems arising at ground level from a rootstock or rhizomes and lacks a single well-defined aerial stem), in having the ultimate cladodes more distinctly flattened, the older stems with a thin waxy layer that exfoliates tardily (this layer is much thinner and less conspicuous than in *B. leptacantha*), rapidly caducous bracteoles, larger flowers, keel petals clothed with scattered woolly hairs apically and in the sinus, and ovaries with scattered hairs on the upper suture. Flower colour also differs. The flowers in *B. leptacantha* are uniformly yellow or sometimes the standard has a basal red flare internally from which red striations radiate into the lamina; in *B. halophila* the standard is yellow internally with a reddish-brown throat from which reddish-brown striations radiate into the lamina.

The ecological preferences of *B. halophila* and *B. leptacantha* differ: *B. leptacantha* favouring sandy soil, clay or clay-loam, often over limestone, and frequently away from salt lake systems, whereas *B. halophila* favours deep sand near salt lake systems. The distribution of the two species does not overlap, *B. leptacantha* occurring much further east than *B. halophila* from the vicinity of Peak Charles in the west to Madura in the east.

34. *Bossiaea oxyclada* Turez., *Bull. Soc. Imp. Nat. Moscou* 26: 284 (1853). *Bossiaea rufa* R. Br. var. *oxyclada* (Turez.) Benth., *Fl. Austral.* 2: 166 (1864). *Type*: 'Drum. V. n. 82'; Western Australia, 1849, *J. Drummond 5th coll. no. 82*; lecto.: KW (here selected); isolecto.: K, MEL *664703*, PERTH.

Rigid erect intricately branched shrub to 90 cm high and 60 cm wide, glabrous or almost so apart from a sparse covering of appressed hairs on the young growth and hairs in the axils of the scale leaves; branches flattened or elliptic, ultimate branches of cladodes 2–4 mm wide, scarcely winged, notched at the nodes, usually terminating in a pungent point, grey-green when young, the outer waxy layer exfoliating with age; bark grey-brown, slightly longitudinally fissured. Leaves reduced on older growth to ovate scales 0.5–1.0 mm long, 0.8–1.1 mm wide, reddish-brown when young but turning black with age, inconspicuously longitudinally striate, often with scattered hairs along the midline especially apically and with marginal cilia, usually glabrescent, persistent. Young growth at base of some plants with alternate unifoliolate leaves, the lamina in these leaves suppressed towards the apex of the shoots and replaced by a terete subulate appendage that exceeds the stipules; lamina rotund or obovate to elliptic-oblong, 4–20 mm long, 4–12 mm wide, emarginate apically, upper surface glabrous, with scattered hairs on lower surface especially on the midrib, margin with appressed hairs, with venation simple craspedodromous; petiole 1.5–3.5 mm long, sparingly pubescent; stipules linear-oblong to narrowly ovate, 1.7–3.5 mm long, 0.5–1 mm wide, slightly asymmetric, shorter or longer than the petiole, green, slightly foliaceous (sometimes apparently 'trifid' on account of a median terete subulate appendage longer than the stipules). Flowers solitary at the nodes, the pedicels 2.0–4.5 mm long, glabrous or with

scattered appressed hairs, dark purplish-red; bracts imbricate, increasing in size from the outermost basal bract to the innermost, broadly ovate, the innermost 1.0–1.3 mm long, 0.6–0.8 mm wide, resembling the bracteoles, rigid, coriaceous, pinkish-brown, not conspicuously longitudinally striate, with conspicuous marginal cilia and sometimes scattered hairs along the midline, usually persisting; bracteoles broadly ovate to oblong or obovate-oblong, 1.0–1.4 mm long, 0.6–0.8 mm wide, usually inserted at about the middle of the pedicel, pinkish-red, with marginal cilia, inconspicuously longitudinally striate, persistent. Calyx glabrous externally except for scattered hairs especially towards the apex of the two upper lobes, pinkish-brown or russet; 2 upper lobes 1.0–1.9 mm long excluding a tube 2.0–4.1 mm long, truncate or rounded, with 3 lower lobes 0.9–1.2 mm long, shorter than the tube, acute. Standard 8.7–12.5 mm long including a claw 2.8–3.8 mm long, 7.3–12.5 mm wide, golden yellow internally with a basal red flare around the throat that extends vertically towards the apex of the lamina as a red patch on either side of the midline, externally red with yellow striations radiating into the lamina from the base; wings 8.0–11.6 mm long including a claw 2.0–3.4 mm long, 2.2–3.5 mm wide, externally pinkish-brown and often suffused with yellow apically; keel 8.2–11.2 mm long including a claw 2.2–3.5 mm long, 3.0–4.2 mm wide, externally deep red, with a conspicuous lateral pouch on either side towards the base, glabrous apically. Stamen-filaments 6.6–10.0 mm long. Ovary 5–6 mm long, on a stipe 1–2 mm long, 6–8-ovulate, glabrous. Pods 1.4–2.3 cm long, 0.5–0.7 cm wide, on a stipe about as long as the calyx-tube, with valves dark brown, conspicuously transversely venose, glabrous. Seeds 2.6–2.8 mm long, 1.5–1.7 mm wide, uniformly olive to chestnut-brown (Fig. 35e).

Distribution and habitat: Occurs in the Eyre Botanical District. Apparently confined to the western portion of the Fitzgerald River National Park where it has been recorded from the vicinity of Twertup Creek (Fig. 40). Grows in deep greyish-white sand in species-rich sandplain community with scattered mallee eucalypts and an understorey dominated by proteaceous and myrtaceous shrubs. Flowers Sept.–Oct.

Representative specimens (9 examined): Fitzgerald River National Park, near Twertup Creek, 27 Aug.1970, *K. Newby 3270* (PERTH); 7 Sept.1971, *A.S. George 10931* (PERTH); c. 23 km along the Rabbit Proof Fence No. 2 SW of the turn-off from the Jerramungup- Ravensthorpe Rd, 7 Sept. 1971, *H. Eichler 21056* (AD); Pabelup Track 1.6 km from the Twertup Creek Track junction, 9 Oct.1997, *B. Archer 820A* (MEL, PERTH).

Conservation status: CALM Conservation Code for Western Australian Flora: Priority Two.

Notes: Known for over 120 years only from the type, a fruiting specimen, the application of the name *B. oxyclada* had been uncertain until recently when specimens collected in the Fitzgerald River National Park enabled the identity of *B. oxyclada* to be established.

Bossiaea oxyclada and *B. leptacantha* are the only rigid leafless species in which the standard petal is held erect like a banner that exhibit a combination of glabrous ovaries, persistent bracteoles, and pedicels that are either glabrous or with scattered appressed hairs. The differences between *B. leptacantha* and *B. oxyclada* are given under the former. As in *B. oxyclada*, *B. saxosa* has persistent bracteoles, but differs in that the calyces are sparingly to densely clothed with appressed hairs, the ovaries have hairs along both sutures, and the petals are a different colour.

35. *Bossiaea saxosa* J. H. Ross, sp. nov.

B. celatae J. H. Ross et *B. simulatae* J. H. Ross affinis, a quibus ovariis glabris praeter pilos grossos marginibus, differt.

Type: Western Australia, Coolgardie Distr., 23 km N of Norseman P.O., 1 km E of Coolgardie–Esperance Hwy, 26 Sept. 2000, *J. H. Ross 4106* & *B. Archer* holo.: PERTH; iso.: CANB, K, MEL *2149666*, NSW.

Erect intricately branched multistemmed shrub to 1.5 m high and 1.5 m wide, with short (to 0.3 mm long) scattered appressed to spreading hairs on the younger growth; branches terete to oval or slightly flattened, ultimate branches of cladodes 1–2 mm wide, scarcely or very narrowly winged, notched at the nodes, terminating in a pungent point, usually with a white waxy surface that exfoliates to reveal a green inner layer when the branches dry. Leaves reduced to dark reddish-brown scales 0.7–1.0 mm long, inconspicuously longitudinally striate, glabrous or almost so apart from marginal cilia and scattered hairs along the midline especially apically. Flowers mostly solitary at the nodes, occasionally paired, the pedicels up to 5 mm long, sparingly to fairly densely clothed with appressed hairs; bracts essentially imbricate but sometimes becoming distant as pedicel elongates, ovate, the uppermost 0.6–1.0 mm long, 0.4–0.8 mm wide, reddish-brown, with conspicuous marginal cilia and hairs externally along the midline especially apically, not conspicuously longitudinally striate, persistent; bracteoles ovate, 0.8–1.3 mm long, usually inserted near the middle of the pedicel, not overlapping the base of the calyx, dark reddish-brown, with marginal cilia, persisting until least the young pods develop. Calyx green suffused with red or brown or rusty-brown throughout, sparingly to densely clothed with appressed hairs externally and with hairs on the margins of the lobes; 2 upper lobes rounded-truncate, 1.6–3.0 mm long excluding the tube 1.6–3.5 mm long, with 3 lower lobes 1.2–2.0 mm long, shorter than the tube, acute or acuminate. Standard 7.2–9.6 mm long including a claw 2.0–2.5 mm long, 8.1–11.0 mm wide, internally usually deep yellow throughout except for a basal red flare around the throat but occasionally cream; wings 6.6–8.2 mm long including a claw 1.2–2.1 mm long, 2.0–3.6 mm wide, deep yellow; keel 6.1–8.2 mm long including a claw (0.8–) 1.5–2.1 mm long, 3.5–4.5 mm wide, pale lemon-yellow, glabrous. Stamen-filaments 5.5–8.0 mm long. Ovary 4.3–7.5 mm long, on a stipe 0.6–1.2 mm long, 7–9-ovulate, glabrous apart from coarse hairs along both sutures and occasionally with scattered hairs on the surface of the valves towards the apex; style 2.0–3.5 mm long. Pods oblong, 1.3–2.1 cm long, 0.4–0.5 cm wide, stipe usually about as long as the calyx-tube and shorter than the upper lobes, with valves purplish-red with green mottles when young but brown at maturity, inconspicuously transversely venose, glabrous apart from appressed hairs along both sutures. Seeds elliptic-oblong, 1.8–2.3 mm long, 1.3–1.4 mm wide, uniformly creamy-brown (Fig. 35b, 42).

Distribution and habitat: Occurs in the central portion of the Coolgardie Botanical District of the Southwestern Interzone where it is confined to a small area N of Norseman (Fig. 40). Favours coarse red soil with scattered large stones (schist) in woodland dominated by *Eucalyptus torquata* Luehm. and *Allocasuarina huegelii* (Ewart & M.Gordon) L.A.S.Johnson with *Ricinocarpos stylosus* Diels as a common understorey species. Flowers Sept.– early Oct.

Representative specimens (11 examined): Coolgardie Distr., 31.7 km from Higginsville Pump Station, S of Kambalda, 8 Dec.1997, *A.A. Mitchell 5054* (MEL, PERTH); 23 km N. of Norseman P.O., 1 km E of Coolgardie-Esperance Hwy, 27 Sept.1999, *B. Archer 1369* (MEL, PERTH); 3 Dec.1999, *B. Archer 1502* (CANB, MEL, NSW, PERTH).

Conservation status: CALM Conservation Code for Western Australian Flora: Priority Two. Currently known from two populations on a single schist hill.

Notes: In *B. saxosa* the bracts at the base of the pedicel are essentially imbricate but become distant from one another as the pedicel lengthens, the standard tends to be longer than wide, the bracteoles are larger than the bracts, and the wings are about as long as the keel.

Etymology: From the Latin *saxosum*, of rocky or stony places; in reference to the stony ground favoured by the species.

36. *Bossiaea flexuosa* J.H.Ross, *sp. nov.*

B. simulatae J.H.Ross affinis, a qua ramis flexuosus propriis, calycibus dense pilis 0.3–0.5 mm longis vestitis, petalis carinae basaliter pallidis viridi-flavis, apicibus atroroseis, differt.

Type: Western Australia, Roe District, Fields Rd, 11.8 km N of intersection of Fields and Rollonds Rds, 81 km SW of Salmon Gums PO, 30 Sept.1998, *J.H. Ross 4050 & B. Archer*; holo.: PERTH; iso.: AD, CANB, K, MEL *2149671*, NSW.

Compact shrub to 60 cm high and 1.5 m wide, with numerous stems arising from the rootstock or rhizomes (lacking a single well-defined aerial stem), growth of current season green, older growth grey-green to purplish, glabrous or almost so apart from a dense covering of appressed silvery hairs on the young growth and hairs in the axils of the scale leaves; branches flattened to elliptic or oval but often quite angular, usually distinctly flexuose, ultimate branches of cladodes 1–3 mm wide, scarcely winged, notched at the nodes, usually terminating in a weak point but scarcely pungent, the outer waxy layer exfoliating to reveal a green pitted inner layer. Leaves on older growth reduced to broadly ovate scales 0.8–1.4 mm long, 0.9–1.4 mm wide, reddish-brown when young but turning black with age, scarious, with marginal hairs and often with scattered hairs along the midline, glabrescent, persistent. Very young growth at the base of some plants occasionally with alternate unifoliolate leaves, the lamina in these leaves suppressed towards the apex of the shoots and replaced by a terete or subterete linear appendage that exceeds the stipules; lamina elliptic to rotund or obovate, 3.4–10.1 mm long, 2.0–6.8 mm wide, acute, emarginate or depressed-retuse apically, coriaceous, glabrous or lower surface and margin sparingly clothed with appressed hairs, with venation simple craspedodromous; petiole 0.4–0.6 mm long; stipules narrowly ovate, oblique basally, 1.5–3.0 mm long, laterally confluent basally, slightly foliaceous (sometimes apparently 'trifid' on account of the terete or subterete linear appendage that exceeds the stipules), greenish-yellow when young but turning brown, greatly exceeding the petiole, with or without marginal cilia, persistent. Flowers solitary or in pairs or threes at the nodes, the pedicels 2.5– 4.5 (–6.5) mm long, densely clothed with appressed to spreading hairs; bracts imbricate, increasing in size from the outermost basal one to the innermost, the innermost broadly ovate to narrowly ovate, 0.5–1.1 mm long, 0.6–1.3 mm wide, reddish-brown, rigid, coriaceous, concave, inconspicuously longitudinally striate, with marginal cilia especially apically, with or without scattered hairs along the midline, persistent; bracteoles narrowly ovate to obovate or obovate-oblong, 0.9–2.0 mm long, 0.5–1.0 mm wide, inserted from near the base to the upper half of the pedicel, reddish-brown, inconspicuously longitudinally striate, with or without scattered hairs along the midline, with marginal cilia apically, persistent at least until the young pods develop. Calyx densely clothed with spreading or appressed hairs 0.3–0.5 mm long, green suffused with dark red or purple on the upper surface and

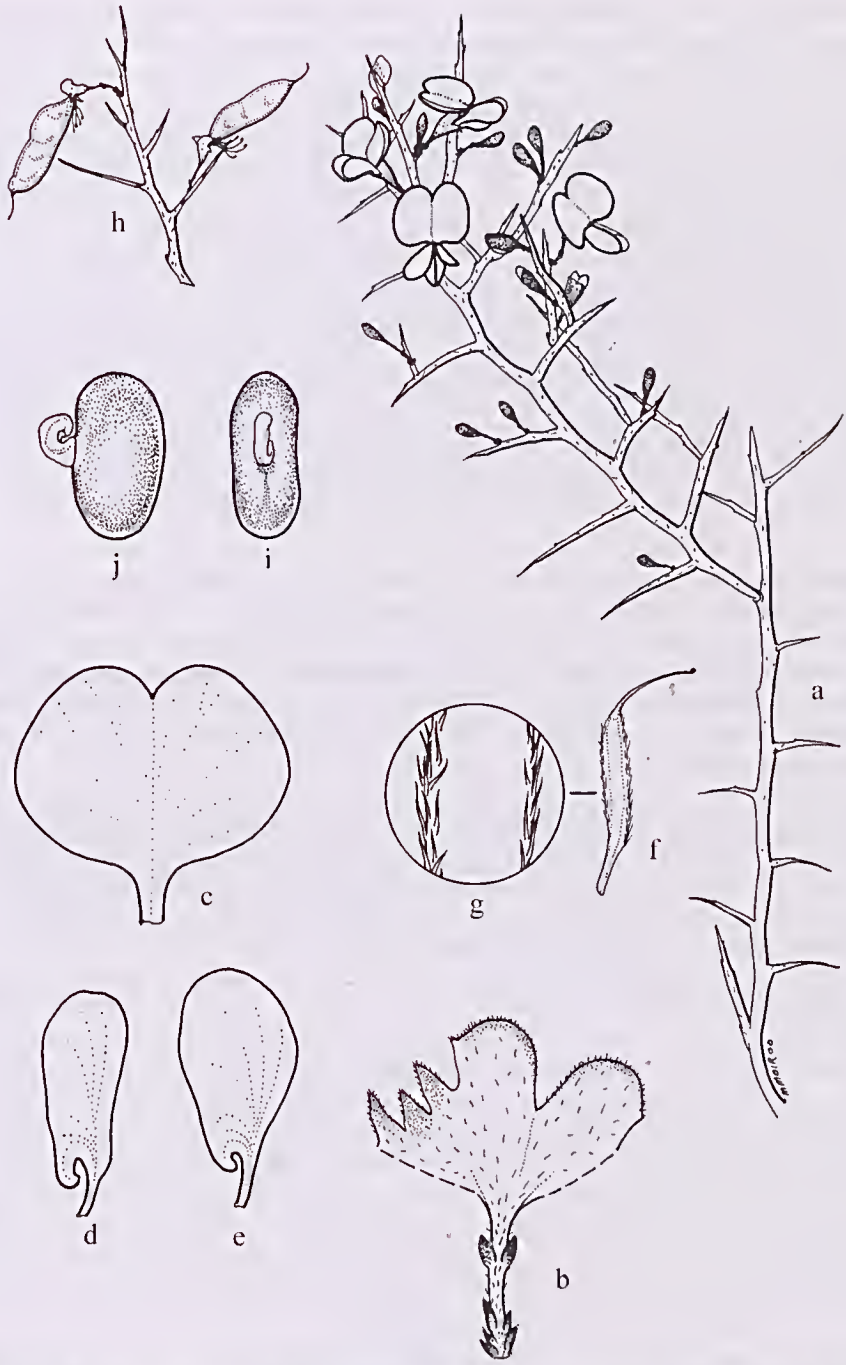

Figure 42. *Bossiaea saxosa* – a, flowering twig, × 1; b, calyx opened out (upper lobes on right) and showing pedicel with persistent bracteoles and basal bracts, × 4; c, standard, × 4; d, wing petal, × 4; e, keel petal, × 4; f, gynoecium, × 4; g, enlarged surface of ovary showing the coarse hairs along both sutures, × 20; h, fruiting twig, × 1; i, seed, hilar view, × 10; j, seed, lateral view, × 10. a–g from *B. Archer 1369*; h–j from *B. Archer 1502*.

towards the apex of the lobes or dark red to purple throughout; 2 upper lobes rounded-truncate, 1.0–2.7 mm long excluding the tube 2.0–4.5 mm long, with 3 lower lobes 0.8–1.7 mm long, shorter than the tube, acute. Standard 8.5–12.5 mm long including a claw 3.0–5.2 mm long, 7–11 mm wide, internally golden yellow with a reddish-brown margin and a pinkish-red basal horseshoe-shaped flare around a paler yellow throat, externally deep red to pinkish-brown in bud but yellow suffused with blush-pink and/or brown when open; wings 7.5–11.5 mm long including a claw 2.6–4.1 mm long, 1.9–3.2 mm wide, externally pinkish or orange basally, yellow suffused with brown apically; keel 7.7–11.0 mm long including a claw 3.0–4.2 mm long, 2.8–4.4 mm wide, externally pale greenish-yellow basally, deep pinkish-red apically, glabrous or with a few scattered hairs apically in the sinus but not woolly-pubescent. Stamen-filaments 5.1–9.9 mm long. Ovary 3.8–6.5 mm long, on a stipe 1.1–2.0 mm long, 5–8-ovulate, densely clothed with villous hairs except along the lateral marginal sutures which lack hairs; style 2.3–4.3 mm long. Pods oblong, 1.0–1.6 cm long, 0.4–0.6 cm wide, on a stipe about as long as the calyx-tube, with valves reddish-brown, inconspicuously transversely venose, with scattered hairs up to 0.6 mm long but hairs absent along the sutures. Seeds 2.3–2.6 mm long, 1.5–1.7 mm wide, cream to beige with purplish mottles, aril translucent (Fig. 35a, 43).

Distribution and habitat: Occurs in the Roe, Eyre and Coolgardie Botanical Districts from about 40 km NW of Norseman in the north and 140 km E of Hyden in the W, southwards towards Salmon Gums and the Young River (Fig. 40). Favours deep sandy soil in sandplain (kwongan) and open mallee or eucalypt woodland. In the type locality confined to a community dominated by *Eucalyptus tetragona* (R.Br.) F.Muell., *Callitris tuberculata* R.Br. ex R.T.Baker & H.G. Sm. and *Melaleuca linguiformis* Craven. Flowers Sept.–Nov.

Representative specimens (18 examined): c. 18 km NNW of Young River crossing on Ravensthorpe-Esperance Rd, 16 Oct.1968, *E.N.S. Jackson 1444* (AD, PERTH). c.140 km E of Hyden, 29 Oct.1991, *B.H. Smith 1582* (MEL). Kumarl-Lake King Rd, 53 km W of Norseman, 23 Sept.1996, *M.G. Corrick 11223* (MEL, PERTH). Fields Rd, 81 km SW of Salmon Gums P. O., 20 Dec.1997, *B. Archer 925* (MEL). New Norseman–Hyden Track, 40.6 km NW of Norseman, 10 Oct.1999, *B. Archer 1413* (CANB, MEL, NSW, PERTH).

Conservation status: CALM Conservation Code for Western Australian Flora: Priority Three.

Notes: In its low habit, *B. flexuosa* is reminiscent of *B. simulata*, *B. leptacantha,* and *B. celata*. *B. flexuosa* differs from *B. simulata* in having distinctly flexuose branches, the calyx densely clothed with spreading hairs 0.3-0.5 mm long, differently coloured standard and keel petals, and a more westerly distribution. *Bossiaea flexuosa* is distinguished readily from *B. leptacantha* in having distinctly flexuose cladodes, densely pubescent ovaries and different coloured flowers, and from *B. celata* in having persistent bracteoles and lacking dense hairs on the lateral sutural margins of the ovary.

Wind-blown sand sometimes accumulates around the base of plants and plants spread by sending up aerial shoots from the rhizome.

Etymology: From the Latin *flexuosus*, zigzag; in reference to the zigzag nature of the young stems that bend alternately in opposite directions.

37. *Bossiaea simulata* J.H.Ross, *sp. nov.*

B. flexuosae J.H.Ross affinis, a qua ramis non vel interdum tantum flexuosis, calycibus pilis ad 0.3 mm longos appressis ad leviter effusos vestitis dense, petalis

carinae ubique pallide viridi-flavis vel basaliter aurantio-rubris, differt; qua *B. saxosae* J.H.Ross et *B. celatae* J.H.Ross ovariis praeter marginibus lateralibus ubique dense pilis vestitis, differt.

Type: Western Australia, Roe Distr., 21 km W of Mt Willgonarinya, 1 Nov.1997, *B. Archer 850* ; holo: PERTH; iso.: CANB, K, MEL *2149923*, NSW.

Compact shrub to 0.9 m high and 1 m wide, with numerous stems arising from the rootstock (lacking a single well-defined aerial stem), dull greyish-green, glabrous or almost so apart from a dense covering of appressed to slightly spreading white hairs on the young growth and hairs in the axils of the scale leaves, glabrescent; branches flattened or elliptic, occasionally slightly flexuose, ultimate branches of cladodes 1.5–3.0 mm wide, scarcely winged, notched at the nodes, usually terminating in a pungent point, the outer waxy layer exfoliating to reveal a pitted green inner surface. Leaves reduced to ovate scales 0.6–1.2 mm long, 0.8–1.0 mm wide, reddish-brown when young but turning black with age, inconspicuously longitudinally striate, usually with scattered hairs along the midline especially apically, with marginal cilia, usually glabrescent, persistent. Flowers solitary or in pairs or threes at the nodes, the pedicels 1.8–4.6 mm long, densely clothed with appressed to spreading hairs; bracts imbricate, usually 3–5, increasing in size from the outermost basal one to the innermost, broadly ovate or oblong, the innermost largest, 0.8–1.2 mm long, 0.6–1.2 mm wide, rigid, coriaceous, concave, reddish-brown, not conspicuously longitudinally striate, with scattered hairs along the midline externally and a fringe of marginal cilia or sometimes with scattered hairs throughout, usually persisting together with the outer bracts; bracteoles narrowly ovate to slightly obovate, 0.9–2.0 mm long, 0.7–1.2 mm wide, inserted between one-third and two-thirds of the length of the pedicel, often subopposite, seldom overlapping the base of the calyx, reddish-brown, usually with scattered hairs throughout and on the margins, less coriaceous than the bracts, persistent. Calyx densely clothed with appressed to slightly spreading hairs up to 0.3 mm long, green suffused with red; 2 upper lobes rounded-truncate, 0.8–1.5 mm long excluding the tube 1.7–2.9 mm long, with 3 lower lobes 0.8–1.4 mm long, shorter than the tube, acute. Standard 7.5–10.1 mm wide including a claw 2.7–4.2 mm long, 6.5–8.5 mm wide, longer than the keel, golden yellow internally with a basal red horseshoe-shaped flare around a greenish-yellow throat or uniformly yellow and lacking the basal red flare, yellow externally but suffused with red especially towards the margin and with longitudinal red striations radiating from the base into the lamina; wings 6.8–9.5 mm long including a claw 2.2–3.1 mm long, 1.7–2.5 mm wide, yellow internally throughout or with basal red markings, externally yellow basally, russet-brown apically; keel 6.7–8.8 mm long including a claw 2.7–3.5 mm long, 2.7–3.7 mm wide, externally pale greenish-yellow throughout or orange-red basally, glabrous. Stamen-filaments 4.7–9.4 mm long. Ovary 4.0–5.1 mm long, on a stipe 1.2–1.8 mm long, 6–9-ovulate, densely pubescent except for glabrous lateral margins; style 2.5–3.0 mm long. Pods oblong, 1.2–1.9 cm long, 0.4–0.6 cm wide, on a stipe about as long as the calyx-tube and not exceeding the upper lobes, with valves pinkish-brown, inconspicuously transversely venose, clothed with scattered spreading hairs up to 0.8 mm long except on the margins of the sutures. Seeds 2.3–2.7 mm long, 1.4–1.7 mm wide, cream to beige with scattered purplish mottles (Figs 35e, 44).

Distribution and habitat: Occurs in the eastern portion of the Roe Botanical District from south of Mt Malcolm south-eastwards towards Mt Willgonarinya (Fig. 45). Favours well-drained sandy loam in low open *Eucalyptus* woodland, often on raised

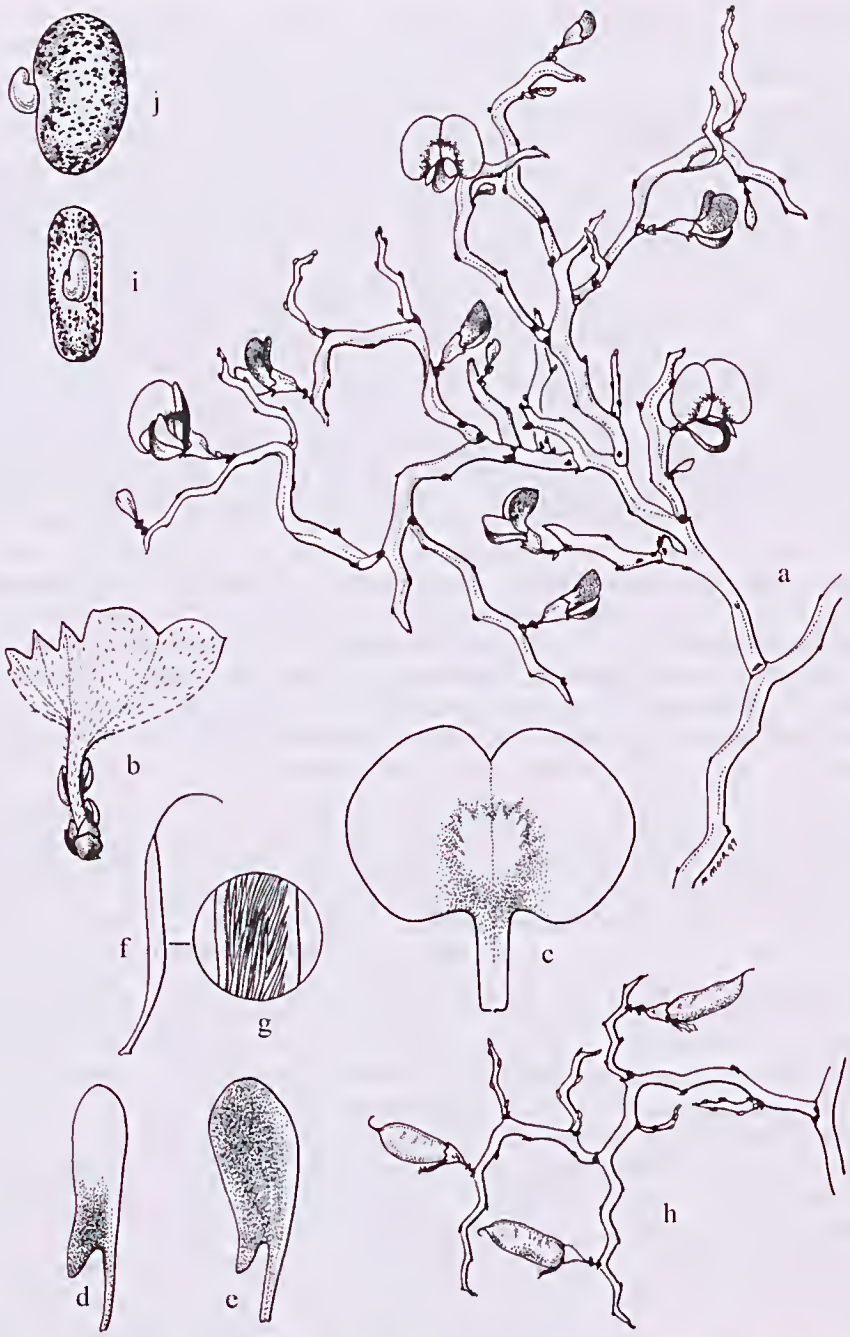

Figure 43. *Bossiaea flexuosa* – a, flowering twig showing the charaeteristie flexuose braneh es, ×1; b, ealyx opened out (upper lobes on right) and showing pedieel with persistent braeteoles and basal braets, ×4; e, standard, ×4; d, wing petal, ×4; e, keel petal, ×4; f, gynoeeium, ×4; g, surfaee of ovary whieh is densely elothed with villous hairs exeept along the lateral marginal sutures whieh are glabrous, ×20; h, fruiting twig, ×1; i, seed, hilar view, ×10; j, seed, lateral view, ×10. a–g from *Ross 4050 & B. Archer*; h–j from *B. Archer 925.*

islands or on peninsulas that protrude into salt lakes, or on sand dunes above the samphire zone. Flowers early Oet.–Dee.

Representative specimens (8 examined): 23 km S of Mt Maleolm, Fraser Range, 5 Oet.1980, K. *Newby 7753* (PERTH). 18 km W of Mt Willgonarinya, 27 Oet.1990, *W.R. Archer 27109030* (CANB, MEL); 26 Dee.1997, *B. Archer 946* (MEL, PERTH); *948* (MEL, PERTH).

Conservation status: CALM Conservation Code for Western Australian Flora: Priority Two.

Notes: *Bossiaea sinuulata* differs from *B. flexuosa* in that the braneh es are not or are oeeasionally only slightly flexuose, the ealyx is densely elothed with appressed to slightly spreading hairs up to 0.3 mm long, and the keel petals are pale greenish-yellow throughout or orange-red basally. As in *B. flexuosa*, in *B. sinuulata* the ovary is densely pubeseent exeept for the glabrous lateral margins, and the braeteoles persist.

Bossiaea sinuulata is superfieially similar to *B. saxosa* and *B. celata* but the three speeies differ in several eharaeters as follows:

	B. sinuulata	*B. celata*	*B. saxosa*
Seale leaves	0.6–1.2 mm long	0.9–3.3 mm long	0.7–1.0 mm long
Innermost braet	0.6–1.2 mm wide	1.5–2.6 mm wide	0.4–0.8 mm wide
Braeteoles	persistent, 0.9–2 mm long, 0.7–1.2 mm wide	usually eadueous, 2–3.6 mm long, 0.9–2 mm wide	persistent, 0.8–1.3 mm long, 0.5–0.8 mm wide
Lower ealyx lobes	1.0–1.4 mm long	1.5–2.5 mm long	1.5–2.0 mm long
Ovary	densely pubeseent exeept along lateral margins	densely pubeseent throughout	glabrous apart from hairs along the margins

Bossiaea saxosa is distinguished from *B. sinuulata* most readily by having glabrous ovaries apart from eoarse seattered hairs along the margins. In addition, flowering time appears to differ, *B. saxosa* flowering in September and early Oetober whereas *B. sinuulata* flowers from late Oetober to Deeember. *Bossiaea celata* differs from *B. sinuulata* in having usually eadueous braeteoles, the ovaries densely pubeseent throughout, and an earlier flowering season.

Flower eolour in *B. sinuulata* varies within a single population. The standard is either uniformly yellow internally apart from a paler yellow throat, or a basal red horseshoe-shaped flare is present around the throat. The standards in up to two-thirds of the plants in a population may have the basal red flare.

Etymology: From the Latin *sinuulans*, imitating or resembling; in referenee to the superficially similar resemblanee of *B. sinuulata* to *B. celata.*

38. *Bossiaea celata* J.H.Ross, *sp. nov.*

B. flexuosae J.H.Ross, *B. sinuulatae* J.H.Ross et *B. saxosae* J.H.Ross affinis, a quibus bracteolis plerumque eadueis eito, ovariis ubique dense pilis vestitis, differt.

Type: Western Australia, Coolgardie Distriet, 99.7 km W of Coolgardie on Coolgardie-Southern Cross rd, Boorabbin National Park, 3 Oet.1998, *J.H. Ross 4058* & *B. Archer*; holo.: PERTH; iso.: CANB, K, MEL *2149678*, NSW.

Compact intricately branched shrub to 0.8 m high and 3 m wide, with numerous stems arising from the rootstock (lacking a single well-defined aerial stem), growth of current season bluish-grey tinged with purple when young, glabrous or almost so apart from a dense covering of appressed to slightly spreading white hairs on the young growth and hairs in the axils of the scale leaves, dark grey to blackish when older; branches flattened or elliptic but often quite angular, sometimes somewhat flexuose, ultimate branches of cladodes 2–3 mm wide, scarcely winged, notched at the nodes, usually ending in a pungent point, the outer waxy layer exfoliating to reveal a pitted green inner surface. Leaves reduced to ovate scales 0.9–3.3 mm long, 0.8–2.1 mm wide, reddish-brown when young but turning black with age, conspicuously or inconspicuously longitudinally striate, with scattered hairs along the midline especially apically and on the margins, glabrescent, persistent. Flowers solitary or paired at the nodes, the pedicels 1.5–4.0 mm long, densely clothed with appressed to spreading hairs; bracts imbricate, usually 5–7, increasing in size from the outermost basal one to the innermost, broadly ovate, concave, rigid, coriaceous, brown, inconspicuously longitudinally striate, with scattered hairs along the midline externally especially apically, and a dense fringe of marginal cilia, the innermost largest bract 1.0–3.3 mm long, 1.5–2.6 mm wide, caducous or persistent; bracteoles narrowly ovate, 2.0–3.6 mm long, 0.9–2.0 mm wide, inserted near the base of the pedicel, brown, inconspicuously longitudinally striate, with scattered hairs along the midline externally and marginal cilia, less coriaceous than the bracts, usually rapidly caducous. Calyx densely clothed with appressed to slightly spreading hairs, green but suffused with pink or red especially on the upper surface and lobes; 2 upper lobes truncate, 1.2–2.4 mm long excluding the tube 2.2–4.6 mm long, acute, with 3 lower lobes 1.2–2.5 mm long, shorter than the tube, acute to acuminate. Standard 8.7–11.6 mm long including a claw 3.5–5.2 mm long, 7.6–11.0 mm wide, usually slightly longer than the keel, internally yellow with a delicate pinkish-red basal horseshoe-flare around two basal greenish-yellow 'eyes' in the throat, externally the basal yellow 'eyes' surrounded by a pinkish-red horseshoe-shaped zone that gives way to red then pinkish-brown; wings 8.0–10.3 mm long including a claw 2.4–3.5 mm long, 2–3 mm wide, externally pinkish-red basally, orange-yellow or brown apically; keel 8.0–10.4 mm long including a claw 2.8–4.2 mm long, 3.2–4.1 mm wide, externally pinkish-red basally apart from a greenish-white claw, darker red apically, glabrous. Stamen-filaments 5.4–10 mm long. Ovary 4.1–5.7 mm long, on a stipe 1.3–2.6 mm long, 7–9-ovulate, densely pubescent throughout; style 2.4–4.4 mm long. Pods oblong, 1.5–2.5 cm long, 0.5–0.6 cm wide, stipe about as long as the calyx-tube or just exceeding it, with valves pinkish-brown, densely clothed with appressed to slightly spreading hairs throughout especially on the sutures, inconspicuously transversely venose. Seeds elliptic-oblong, 2.3–3 mm long, 1.5–1.7 mm wide, cream to pale fawn-brown, with scattered purplish mottles but sometimes densely mottled (Fig. 46).

Distribution and habitat: Occurs in the south-western portion of the Coolgardie Botanical District from about 70 km E of Southern Cross southwards towards Mt Day. Favours deep sand in open mallee (Fig. 45). In the type locality growing with *Eucalyptus incrassata*, *E.* sp. aff. *leptophylla* F.Muell. ex Miq., *E. platycorys* Maiden & Blakely, *Allocasuarina spinosissima* (C.A.Gardner) L.A.S.Johnson and a rich understorey of shrubs, especially of Proteaceae (*Grevillea oncogyne* Diels, *G. cagiana* McGillivray, *G. huegelii* Meisn., *G. acuria* Benth., *Hakea erecta* Lamont) and Fabaceae (*Daviesia croniniana* F.Muell., *D. benthamii* Meisn. subsp. *acanthoclona* (F.Muell.) Crisp). Wind-blown sand tends to accumulate around the base of young plants. Flowers Sept.–Oct.

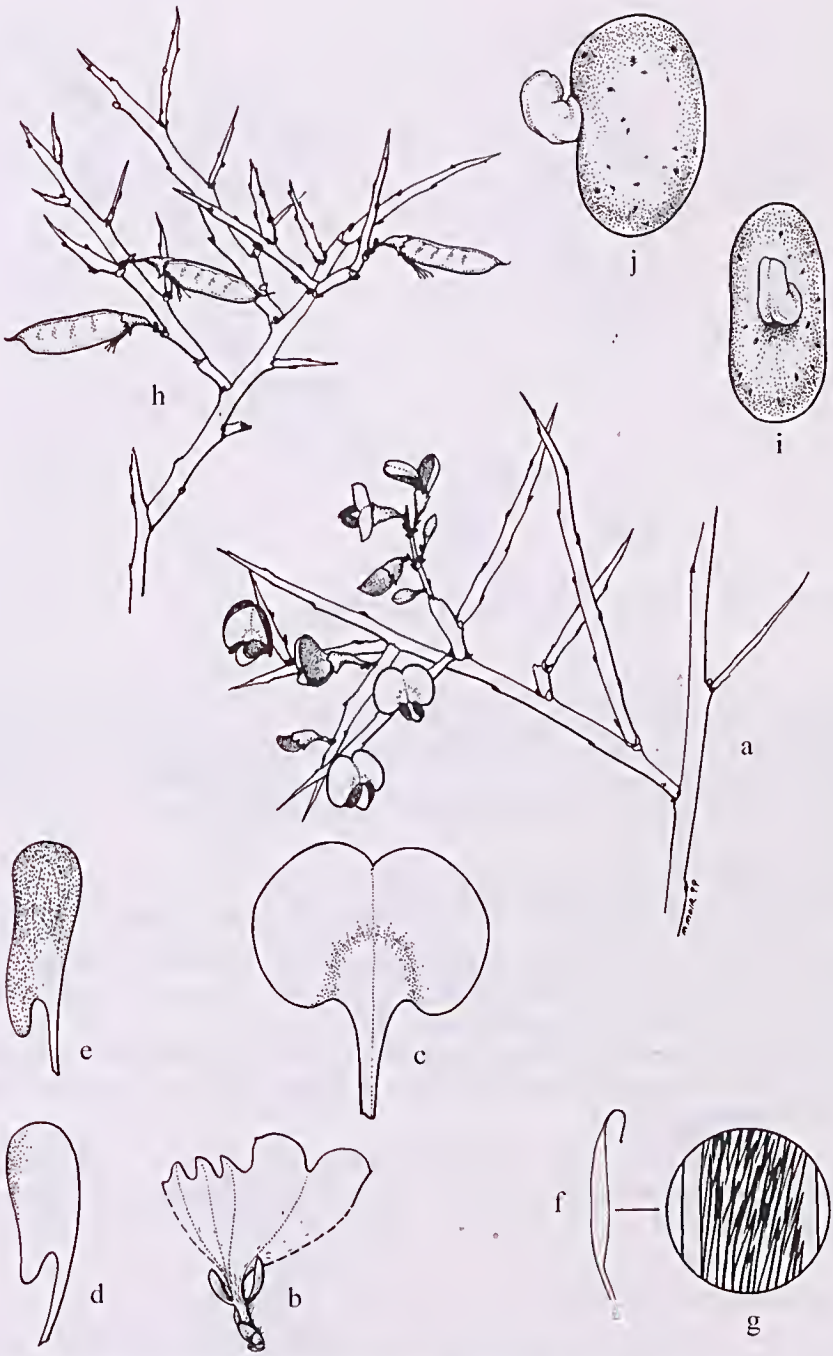

Figure 44. *Bossiaea simulata* – a, flowering twig, ×1; b, calyx opened out (upper lobes on right) and showing pedicel with persistent bracteoles and basal bracts, ×4; c, standard, ×4; d, wing petal, ×4; e, keel petal, ×4; f, gynoecium, ×4; g, surface of ovary which is densely pubescent except along the lateral marginal sutures which are glabrous, ×20; h, fruiting twig, ×1; I, seed, hilar view, ×14; j, seed, lateral view, ×14. a–g from *B. Archer 850*; h–j from *B. Archer 950*.

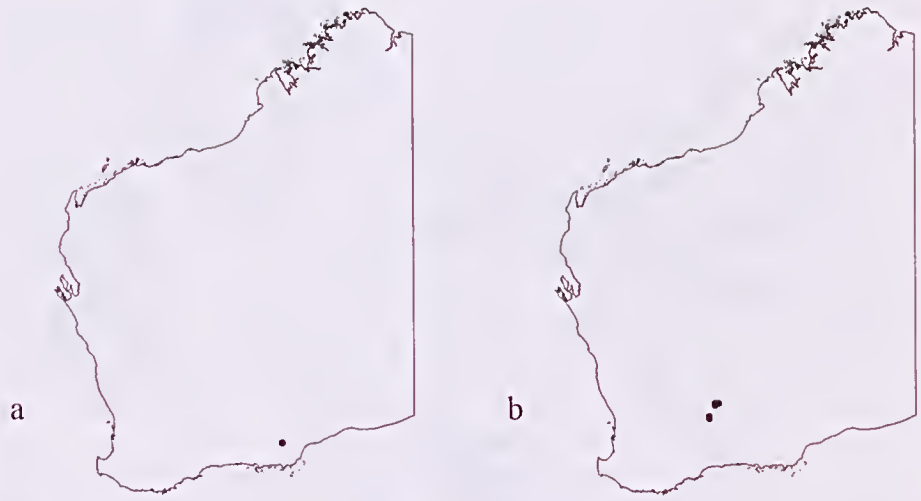

Figure 45. Distributions of a, *Bossiaea simulata*; b, *B. celata.*

Representative specimens (15 examined): c. 87.2 km E of Southern Cross towards Coolgardie, 9 Sept.1968, *M.E. Phillips s.n.* (CANB, PERTH). 10 km SSE of Duri, c. 76 km E. of Southern Cross, 24 Sept.1979, *K. Newby 6087* (PERTH). c. 61 km SE of Marvel Loch on Mt Day Rd, 28 Oct.1991, *B.H. Smith 1573* (CANB, MEL, NSW, PERTH). 6.5 km E of Boorabbin Microwave Tower, 87 km E of Coolgardie P.O., 7 Nov.1999, *B. Archer 1485* (AD, MEL, PERTH).

Conservation status: CALM Conservation Code for Western Australian Flora: Priority Three. Localised but common where it occurs and exists in large communities.

Notes: Resembles *B. leptacantha, B. flexuosa,* and *B.simulata* in being of low stature. From each of these it differs in that the bracteoles are usually rapidly caducous and the ovary is densely pubescent throughout.

The flowers are borne at or near the apex of the plants and often the slender stems bearing flowers arise near the base of the plant and weave their way vertically through the tangled mass of branches.

Etymology: From the Latin *celatus*, concealed; in reference to the difficulty experienced in locating plants in the field which tend to blend into the surrounding vegetation.

EXCLUDED WESTERN AUSTRALIAN SPECIES

Bossiaea aculeata F. Muell., *Fragm.* 2: 120 (1861) = ***Templetonia aculeata*** (F. Muell.) Benth., *Fl. Austral.* 2: 170 (1864). *Type*: Western Australia, near the Culjong River, *A. Oldfield*; holo.: MEL *20339.*

Bossiaea biloba Benth. in S.F.L.Endlicher *et al., Enum. Pl. Nov. Holl.* 36 (1837) = ***Cristonia biloba*** (Benth.) J. H. Ross, *Muelleria* 15: 11 (2001). *Type*: Western Australia, Darling Botanical District, King Georges Sound, *Hügel*; holo.: W.

Figure 46. *Bossiaea celata* – a, flowering twig, ×1; b, ealyx opened out (upper lobes on right) and showing pedieel with upper larger braet overlapping the base of the ealyx (on left) and the basal bracts (the braeteoles having been shed), ×4; c, standard, ×4; d, wing petal, ×4; e, keel petal, ×4; f, gynoeeium, ×4; g, surfaee of ovary whieh is densely pubseent throughout, ×20; h, fruiting twig, ×1; i, seed, hilar view, ×10; j, seed, lateral view, ×10. a–g from *Ross 4058 & B Archer*; h–j from *Archer 1485*.

Bossiaea strigillosa Benth., Fl. Austral. 2: 157 (1864) = **Pultenaea rotundifolia** (Turez.) Benth., Fl. Austral. 2: 121 (1864). Type: Western Australia, J. Drummond 5th coll.?, no. 81; lecto.: K.

Bossiaea sulcata Meisn. in J.G.C.Lehmann, *Pl. Preiss.* 1: 81 (1844) = ***Templetonia sulcata*** (Meisn.) Benth., *Fl. Austral.* 2: 171 (1864). *Type*: Western Australia, Avon Botanical District, Avon River, York, *Preiss 1028*; lecto.: NY, here selected; isolecto.: K, LD, MEL *20340.*

Acknowledgements

I wish to express my appreciation to Basil and Mary Smith of Manmanning for their hospitality on several occasions and for responding to numerous requests over the years and collecting excellent material; my former colleague Margaret Corrick for collecting many interesting excellent specimens and who, until the species was described formally, was the only person to collect *B. modesta;* Barbara Archer of Norseman who has pursued species of *Bossiaea* relentlessly and with great vigour for a number of years and in so doing has extended the range of distribution of many known species considerably, discovered a previously unknown species (*B. arcuata*), collected numerous beautifully prepared specimens with accompanying photographs and contributed much to the current understanding of the genus; Mike Hislop, Western Australian Herbarium, who discovered and drew my attention to the taxon here described as *B. laxa* and to a number of other interesting specimens; Russell & Matthew Barrett, Kings Park and Botanic Garden, for drawing my attention to the taxon here described as *B. barrettiorum*; Greg Keighery, Department of Conservation and Land Management, for information about *B.* sp. Waroona; Catriona McPhee, Museum of Victoria, for identifying the insects responsible for gall formation in *B. eremaea*; Messrs Ian Brooker, Lyn Craven and Bruce Maslin for identifying respectively specimens of *Eucalyptus*, *Melaleuca* and *Acacia* growing in association with *Bossiaea* species; a succession of Australian Botanical Liaison Officers based at the Herbarium, Royal Botanic Gardens, Kew, for responding to queries; the Directors of AD, CANB, DNA, K, LD, NY, PERTH and W for the loan of specimens or access to their collections; Sara Maroske and Monika Wells, successive Project Officers for the Mueller Correspondence Project, for access to copies of correspondence to and from Mueller; Mali Moir for executing the illustrations; Jenny Tonkin for assistance in compiling distribution data, generating the distribution maps, and preparing the figures; and my colleague Neville Walsh for correcting the Latin diagnoses.

References

Beard, J.S. (1980). A new phytogeographic map of Western Australia. *Western Australian Herbarium Research Notes* **3**: 37–58.

Bentham, G. (1863a). Preface to *Flora Australiensis*, Vol.1, p. 10. Lovell Reeve & Co., London.

Bentham, G. (1863b). Letter to F. Mueller dated 12 October 1863. RB MSS M4, Library, Royal Botanic Gardens, Melbourne.

Bentham, G. (1864). *Flora Australiensis*, Vol. 2, Lovell Reeve & Co., London.

Bentham, G. (1867). Letter to F. Mueller dated 17 November 1867. RB MSS M4, Library, Royal Botanic Gardens Melbourne.

Crisp, M.D. and Cook, L.G. (2003). Phylogeny and embryo sac evolution in the endemic Australasian papilionoid tribes Mirbelieae and Bossiaeeae. In Klitgaard, B.B. and Bruneau, A (eds) *Advances in Legume Systematics* **10**: 253 –268. Royal Botanic Gardens, Kew, England.

Desmond, R. (1994). *Dictionary of British and Irish Botanists and Horticulturists.* Taylor & Francis Ltd. and The Natural History Museum, London.

Erickson, R. (1969). *The Drummonds of Hawthornden.* Lamb Patterson Pty Ltd, Osborne Park, Western Australia.

Hickey, L.J. (1973). Classification of the architecture of dicotyledonous leaves. *American J. Botany* **60**: 17–33.

Keighery, G. (1996). Boranup Bossiaea *(Bossiaea disticha)*: Distribution and Biology. *Western Australian Naturalist* **21**: 97–101.

Mueller, F.J.H (1863). Letter to G. Bentham dated 12 December 1863. Royal Botanic Gardens, Kew Correspondence, Australia, Mueller, 1858–1870, ff. 128–134.

Mueller, F.J.H. (1866). Letter to G. Bentham dated 5 February 1866. Royal Botanic Gardens Kew Correspondence, Australia, Mueller, 1858–1870, ff. 196–201.

Ross, J.H. (1994a). Notes on Western Australian *Bossiaea* species (Fabaceae): 1. *Muelleria* **8**: 201–209.

Ross, J.H. (1994b). Notes on Western Australian *Bossiaea* species (Fabaceae): 2. *Muelleria* **8**: 211–221.

Ross, J.H. (2001). The identity of *Bossiaea strigillosa* Benth. (Fabaceae: tribe Bossiaeae). *Muelleria* **15**: 31–32.

Ross, J.H. (2004). Proposal to conserve the name *Bossiaea* Vent. over *Platylobium* Sm. *Taxon* **53**(4): 1075–1076.

Ross, J.H. & Crisp, M.D. (2005). Tribe *Bossiaeeae*. In Lewis et al. (eds), *Legumes of the World* 354–359. Royal Botanic Gardens, Kew.

Wheeler, J.R. (1987) Papilionaceae (Fabaceae). In Marchant, N.G. et al., *Flora of the Perth Region*, Part 1. Western Australian Herbarium, Western Australia.

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Corrigendum

Muelleria 22: 19–76 (2005)

Taxonomic studies in the *Grevillea victoriae* F.Muell. species complex (Proteaceae: Grevilleoideae) I. Descriptions of nine previously segregated, and three new taxa.

– V. Stajsic & W.M. Molyneux

Listed here are several minor replacements necessary for the Key to Species and in general text.

Key to Species

P24, couplet 1, line 1

1. Leaf upper surface distinctly finely to coarsely granulose (usually rough to touch); branchlets subvillous; leaf lower surface loosely subvillous to villous 2

P25, couplet 4

4. Flower buds at all stages wholly reddish-ferruginous; perianth-limb (just prior to release of style-end) (3.8–) 4.0–4.8 mm wide in side-view; perianth outer surface below the limb densely subvillous, epidermis usually not visible or occasionally partially visible; tepal inner surface uniformly pinkish-red; dorsal tepals 1.9–2.5 mm wide..... *G. callichlaena*

4a. Flower buds at all stages never reddish-ferruginous; perianth-limb (just prior to release of style-end) 2.5–3.2 mm wide in side-view; perianth outer surface below the limb usually loosely subvillous, epidermis visible; tepal inner surface bichromatic; dorsal tepals 1.2–2.2 mm wide 5

P27, couplet 20, line 4

20. Very early flower buds with a purplish-pink, silvery-lilac or pale-pink perianth below the limb, limb pale-brown or dirty greyish-brown; the inner surface of the recurved portion of the perianth below the limb in an open flower usually bichromatic, usually with a central blotch ..... *G. miqueliana* subsp. *cincta*

Main text corrigenda:

P24 DELETE heading **Indumentum terminology**

P30, Figure 1.f.) DELETE triangle shown at Albury/Wodonga. These are F. Mueller collections from the 'Hume River', which were possibly collected somewhere near Corryong.

P32, para 2, line 10: *Grevillea parvula* has a subglobose perianth-limb and the limb segments are **rarely obscurely midline-keeled.**

P36, last para, line 10: REPLACE: 'G. brevifolia' with 'G. polychroma'

P40, para 6, lines 4 and 5: DELETE: **'the new growth usually salmon-pink or a combination of salmon-pink and ferruginous on the same plant'**

P44, Species description of *Grevillea miqueliana*, line 8: INSERT: 'new growth ferruginous or **'salmon-pink.''**

P45, Species description of *G. miqueliana*, lines 7 and 8: INSERT: "very early flower buds with the perianth below the limb usually purplish-pink, silvery-lilac or pale pink, the limb pale brown or dirty grayish-brown."

P46, last paragraph, lines 1 and 2: DELETE: **'new growth usually salmon-pink or a combination of salmon-pink and ferruginous on the same plant'**

P47, Table 3. *Grevillea miqueliana*, cell 4 down: REPLACE: 'tomentose' with '**subtomentose**'

P56, para 9, line 5: INSERT: 'densely sericeous, subsericeous or **subtomentose**'

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